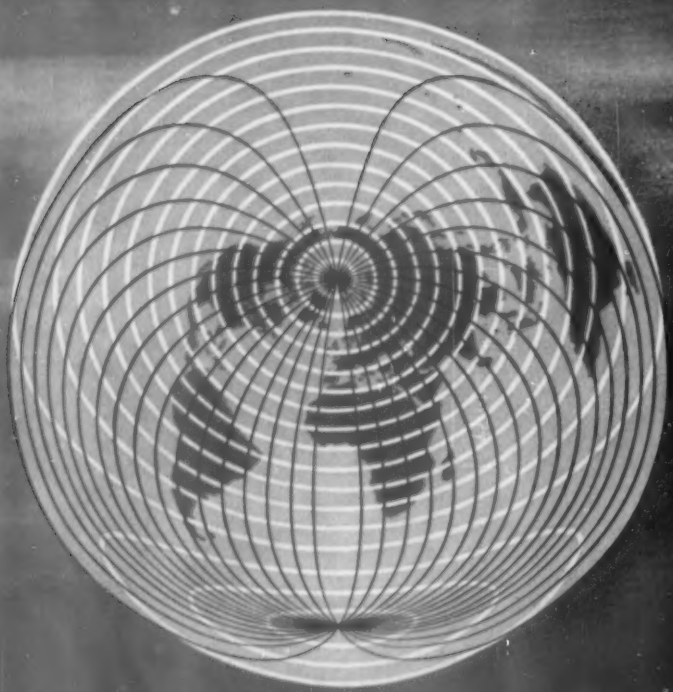
FEBRUARY 1955

TWO SHILLINGS

Wireless World

Radio · Electronics · Television



FORTY-FOURTH YEAR OF PUBLICATION

BICC Callender's

CELLULAR POLYTHENE

in NEW T/V DOWNLEAD developed by

BICC

gives 30% less attenuation with only small increase in size

A low-loss downlead will be necessary in many areas for reception on Band III T/V. Using Cellular Polythene as a dielectric, BICC have developed such a downlead having an attenuation approximately 30% less than the present standard service area type with only a small increase in diameter . . . one of the many ways in which BICC research and development engineers have helped to supply the needs of the telecommunication industry.

If this development can assist you—or if you are just interested—please write for further information.

BRITISH INSULATED CALLENDER'S CABLES LIMITED
21 BLOOMSBURY STREET, LONDON, W.C.1

ALL-ROUND
DEPENDABILITY
AVO VALVE CHARACTERISTIC METER
AVO ELECTRONIC TESTMETER
AVO UNIVERSAL BRIDGE
AVO ELECTRONIC TEST UNIT
THE D.C. AVO MINOR
AVO WIDE RANGE SIGNAL GENERATOR
AVO
Precision ELECTRICAL MEASURING INSTRUMENTS
HEAVY DUTY AVO METER
UNIVERSAL AVO MINOR
UNIVERSAL AVO METER
Dependability is an essential quality in any good electrical testing instrument. Absolute dependability is the outcome of good design, suitability for purpose, and a high standard of accuracy. These indispensable factors are exemplified in all "Avo" Instruments, which are also noteworthy for their compact portability and robust construction.
You can depend on "Avo." When choosing instruments, consult our complete catalogue, a copy of which may be had free on application.
THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
WINDER HOUSE DOUGLAS STREET LONDON S.W.1
Telephone: VICtoria 3404—9

POST THE COUPON TODAY FOR OUR BROCHURE ON THE LATEST METHODS OF HOME TRAINING FOR OVER 150 CAREERS AND HOBBIES

THE ADVANTAGES OF E.M.I. TRAINING

- ★ The teaching methods are planned to meet modern industrial requirements.
- ★ We offer training in all subjects which provide lucrative jobs or interesting hobbies.
- ★ The student is taken carefully and thoroughly through his chosen subject.
- ★ A tutor is personally allotted by name to ensure private and individual tuition.
- ★ Free advice covering all aspects of training is given to students before and after enrolment with us.

NEW

LEARN THE PRACTICAL WAY — COURSES WITH EQUIPMENT

With many courses we supply actual equipment thus combining theory and practice in the correct educational sequence. The equipment, specially prepared and designed, remains your property. Courses include: Radio, Television, Electronics, Draughtsmanship, Carpentry, Photography and Commercial Art, Amateur S.W. Radio, Electricity, Languages, Mechanics, etc.

Equipment supplied upon enrolment and remains your property.

PRIVATE AND INDIVIDUAL TUITION IN YOUR OWN HOME

Accountancy
Advertising
Aeronautical Engineering
Automobile Engineering
Banking
Book-keeping
Building
Business Management
Carpentry
Chemistry
Civil Service
Civil Engineering
Commercial Subjects
Commercial Art & Drawing
Customs & Excise Officer
Draughtsmanship
Dressmaking
Economics
Electrical Engineering
Electronics
Fashion Drawing
Heating & Ventilating Engineering
Industrial Administration
Journalism
Languages
Marine Engineering
Mathematics
M.C.A. Licences
Mechanical Engineering
Motor Engineering
Photography
P.M.G. Licences
Police
Production Engineering
Public Speaking
Radar
Radio & Television Servicing
Radio Engineering
Refrigeration
Retail Shop Management
Salesmanship
Sanitation
Secretaryship
Shorthand & Typing
Sound Recording
Structural Engineering
Tele-communications
Television
Time & Motion Study
Tracing
Welding
Writing
Workshop Practice
Works Management
and many others.

Also courses for University Degrees, General Certificate of Education, B.Sc.Eng., A.M.I.Mech.E., L.I.O.B., A.C.C.A., A.C.I.S., A.M.Brit.I.R.E., A.M.I.I.A., City & Guilds Examinations, R.S.A Certificates, etc.

Courses from 15/- per month

EMI INSTITUTES

THE ONLY POSTAL COLLEGE WHICH IS PART OF A WORLD-WIDE INDUSTRIAL ORGANISATION

POST THIS COUPON TODAY

Please send without obligation your FREE book.

E.M.I. INSTITUTES Dept. 127k,
Grove Park Road, London, W.4.

NAME _____

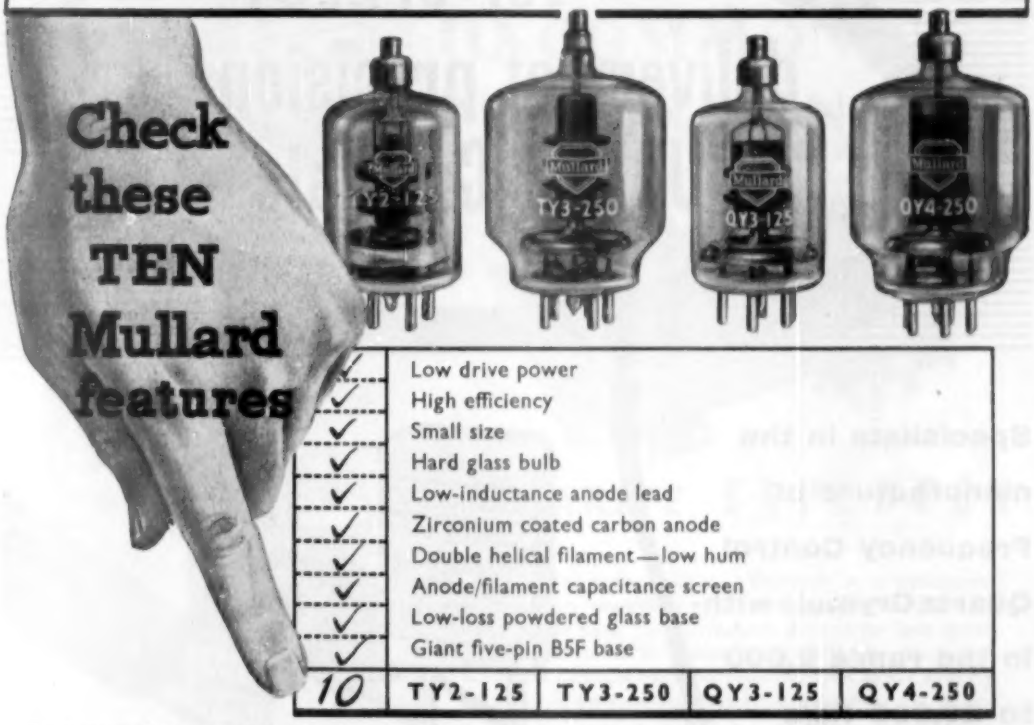
ADDRESS _____

_____

SUBJECT(S) OF INTEREST _____

(We shall not worry you with personal visits) 2/55 IC38a

The Valves for V.H.F.



✓	Low drive power			
✓	High efficiency			
✓	Small size			
✓	Hard glass bulb			
✓	Low-inductance anode lead			
✓	Zirconium coated carbon anode			
✓	Double helical filament—low hum			
✓	Anode/filament capacitance screen			
✓	Low-loss powdered glass base			
✓	Giant five-pin B5F base			
10	TY2-125	TY3-250	QY3-125	QY4-250

Ten features to bear in mind—*plus* the assurance that these valves are already being widely employed with marked success in both comaunications and industry. The triodes TY2-125 (CV1924) and TY3-250 are recommended for grounded-grid R.F. amplifiers in communications equipment and as oscillators in compact R.F. heaters.

The tetrodes QY3-125 (CV2130) and QY4-250 (CV2131)—included in the Services Preferred Types List—are characterized by high power gain and high efficiencies at V.H.F.

Detailed information on the above range and other V.H.F. valves made by Mullard may be readily obtained from the address below.

MAXIMUM OPERATING CONDITIONS (CLASS C TELEGRAPHY) at 50 Mc/s									Max. frequency (Mc/s)
Valve	Type of Service	Va (V)	Vgl (V)	Ia (mA)	Igl (mA)	vin(pk) (V)	P load (W)	η (%)	
TY2—125 (CV1924)	ampl.	2500	-200	205	40	390	310	76	200
TY3—250	ampl.	3000	-250	365	69	430	670	77	150
QY3—125 (CV2130)	ampl.	3000	-150	167	6.5	300	300	75	200
QY4—250 (CV2131)	ampl.	4000	-225	312	9	374	800	80	120

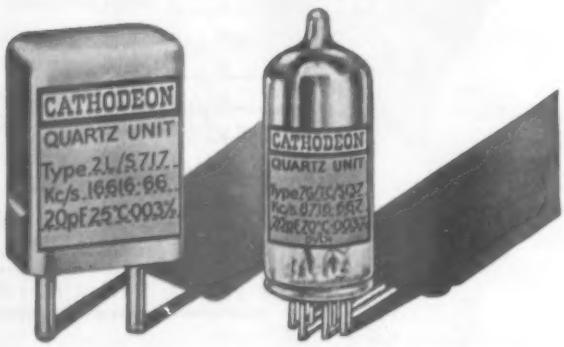
Mullard

MULLARD LTD., COMMUNICATIONS & INDUSTRIAL VALVE DEPT., CENTURY HOUSE, SHAFTESBURY AVENUE, W.C.2

MVT 167

For SPEEDY delivery of precision QUARTZ Crystals

Specialists in the manufacture of Frequency Control Quartz Crystals within the range 2,000 to 20,000 Kc/s



Special Urgency Service

Small urgent orders can now be executed within days, at competitive prices.
Ask for full details.

Tel. LINTON 223

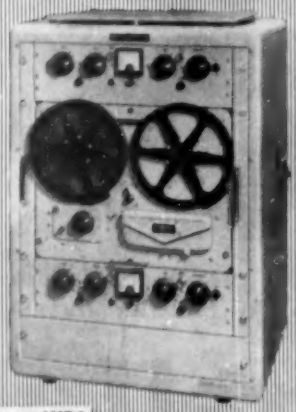
CATHODEON

CRYSTALS LIMITED

LINTON · CAMBRIDGESHIRE

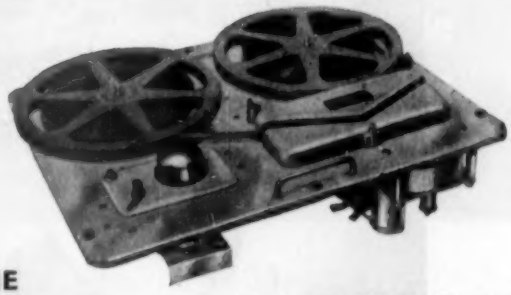
Ferrograph 2A

Ferrograph Model YD



Equipment YDC

A COMMON factor in UNCOMMON PERFORMANCE



THE WEARITE TAPEDECK

The reputation of the 'Tapedeck' is so well-known and so firmly established as to call for no extravagance in describing its many virtues. Indeed, it forms the basis of the recorder instruments in common use in the Defence Services of the United Kingdom and many other countries, as well as being the choice of broadcasting Authorities throughout the World.

FERROGRAPH 2A A reasonably inexpensive instrument approaching professional standards with a specification commending it to those engaged in educational and cultural pursuits.

FERROGRAPH MODEL YD A triple-speed instrument designed mainly for use in the scientific and industrial fields. Principally intended for operation from and into 600 ohm lines, a high gain stage has been provided, however, to allow for recording direct from normal microphones.

EQUIPMENT YDC A simultaneous dual-channel Recorder-Reproducer offering special facilities for analytical research into medical, aeronautical and scientific problems. Any two activities capable of translation into electrical phenomena within the frequency and phase shift limitations can be recorded and replayed simultaneously.

Originators of Tapedecks

WRIGHT & WEAIRE LTD

131 SLOANE ST., LONDON, S.W.1

Phone : SLOane 2214/5 & 1510

Built by Craftsmen ..... Assembly of Scalamp Galvanometers Cat. Nos. W.W. 7901/S-4/S

The

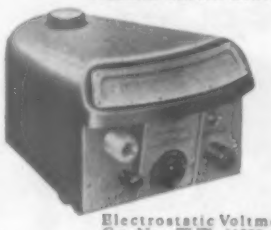
SCALAMP

Range

You are invited to write for details of the instruments illustrated here.

The *Galvanometers* and *Electrostatic Voltmeters* are available in a range of sensitivities—the *Fluxmeter* has a very high performance and a unique return-to-zero device. Outstanding SCALAMP attributes include a truly functional dustproof case, mains or battery operation, and an easy-to-read hairline spot.

Fluxmeter Cat. No. W.W. 8834



Electrostatic Voltmeter Cat. Nos. W.W. 11308-11310

STANDARD EQUIPMENT IN MANY LEADING LABORATORIES

SCIENTIFIC PYE INSTRUMENTS

W. G. PYE & CO. LTD. GRANTA WORKS · CAMBRIDGE · ENGLAND

WG.54

PROFIT BY EXPERIENCE

There is over 30 years' experience behind the **Mullard** EF 80

The Mullard EF80, high slope R.F. Pentode, is the most widely used valve of its type. This is as much due to its remarkable dependability as to its extremely efficient performance. Designed primarily as an R.F. or I.F. amplifier in television receivers, it is also suitable for use as a video amplifier, mixer or synchronising pulse separator.

The dependability of all Mullard valves is the logical outcome of Mullard advanced quantity production techniques, many of which are unique.

When ordering this type, BE SURE TO SPECIFY MULLARD.

PROFIT BY THE EXPERIENCE OF THIS SERVICE ENGINEER

J. Spivey, Service Manager for Messrs. Vallance & Davison, Leeds, Ltd., says:—

"After all, why take chances? I don't. I use Mullard valves as replacements. Their uniformly high standard takes a great deal of worry off my shoulders—Mullard valves are valves you can trust."

Mullard

THE **MASTER** *VALVE*

BLACKBURN • FLEETWOOD • GILLINGHAM • HOVE • LYTHAM-ST. ANNES
MITCHAM • PADIHAM • RAWTENSTALL • WADDON • WANDSWORTH • WHYTELEAFE

MULLARD LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2

MVE114C

Use these?

Paper Capacitors

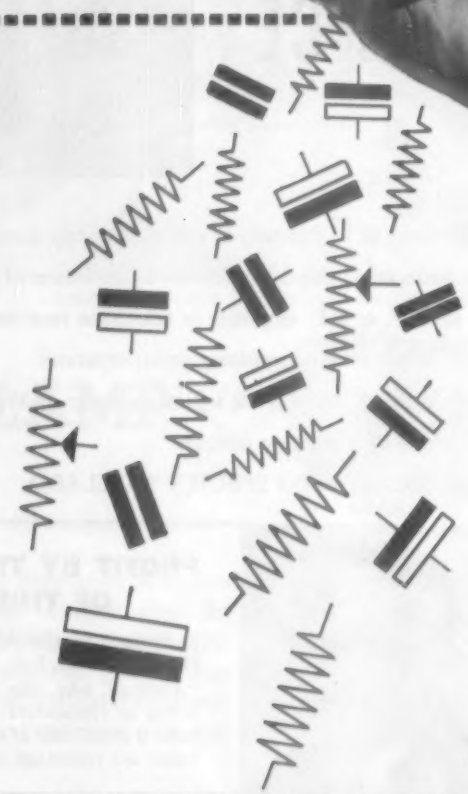
Electrolytic Capacitors

Metallised Paper Capacitors

Wire-Wound Resistors

Composition Resistors

Potentiometers



Use

DUBILIER

DUBILIER CONDENSER COMPANY (1925) LIMITED

DUCON WORKS, VICTORIA ROAD, NORTH ACTON, LONDON, W.3

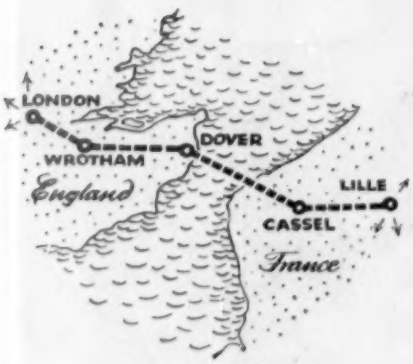
Telephone: ACOrn 2241 (5 lines) Telegrams: Hivoltcon, Wesphone, London. Marconi International Code.

DN 117

Eurovision

The Wayne Kerr Video Oscillator is used by the B.B.C. Engineers to measure the frequency response of the Link over its full bandwidth.

(Photographs by courtesy of the B.B.C.)



Video Oscillator type 022B + 10 to −50 db on 1 volt peak to peak from 10 kc/s — 10 Mc/s. Stabilised output. Less than 1% total distortion. This instrument now includes a 50 c/s square wave output for examination of the low frequency characteristics of video networks.

Full details from:

THE WAYNE KERR LABORATORIES LTD., NEW MALDEN, SURREY

Wayne Kerr

This, together with other new designs for 1955, is fully described in the 1955 edition of Marconi Instruments Catalogue.

MARCONI INSTRUMENTS

SIGNAL GENERATORS · BRIDGES · VALVE VOLTMETERS · Q METERS · WAVEMETERS
FREQUENCY STANDARDS · WAVE ANALYSERS · BEAT FREQUENCY OSCILLATORS

MARCONI INSTRUMENTS LTD · ST. ALBANS · HERTS · Phone: ST. ALBANS 6160/9

30 Albion Street., Kingston-upon-Hull. Phone: Hull Central 16144. 19 The Parade, Leamington Spa. Phone: 1408

Managing Agents in Export:

MARCONI'S WIRELESS TELEGRAPH CO. LTD · MARCONI HOUSE · STRAND · LONDON, W.C.2

TC50

THORN CONTRIBUTIONS TO

space & weight saving

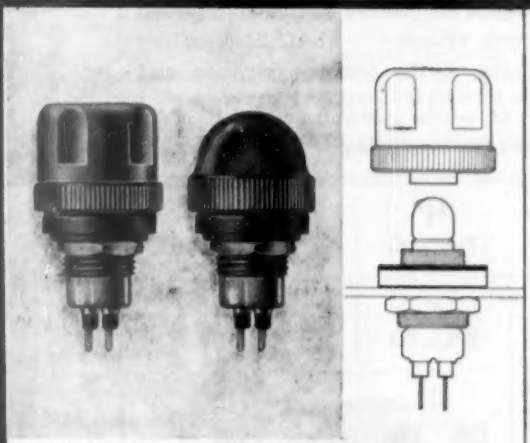
IN EQUIPMENT DESIGN

ATLAS MIDGET PANEL BULB Overall length: 14.6 mm. Bulb diameter: 6.3 mm. Rating: 28v., 1 watt, 0.04 amp. Also available in 12v., 6v. R.A.E. and S.R.D.E. type approval. Flanged cap and single centre contact for easy replacement.

The need for saving space and weight in modern electronic and panel control equipment is an ever present problem. The Atlas Midget panel bulb was designed with these difficulties particularly in mind. Tiny in size, simply and robustly constructed, its success is confirmed by type approval from the R.A.E., Farnborough, and S.R.D.E., Christchurch.

The development of the Atlas Midget panel bulb made possible the production of the Thorn Miniature Sealed Panel Lampholder, which has been developed specifically for the Armed Services. It is available with dimmer or indicator cap, and will withstand conditions of constant vibration and shock.

Brief details are given below, but further enquiries are invited.



DIMMER TYPE INDICATOR TYPE

THORN MINIATURE SEALED PANEL LAMP HOLDERS Overall length including contacts: 1.43 ins. Dia.: .75". Weights: with Indicator Cap 0.276 ozs., with Dimmer Cap 0.644 ozs. Conform to Radio Components Specs. (Prov.) 201, Humidity Class. H.1. Temperature category 40/100 (−40°C. to + 100°C.). Pressure sealed to 20 lbs./square inch.

Completely weatherproof and will withstand conditions of constant vibration and shock. Rotation of the dimmer cap controls the light output from bright to dim by means of an internal metal shutter. Developed originally for A.F.V.'s, Thorn Miniature Sealed Lampholders have many other obvious applications.

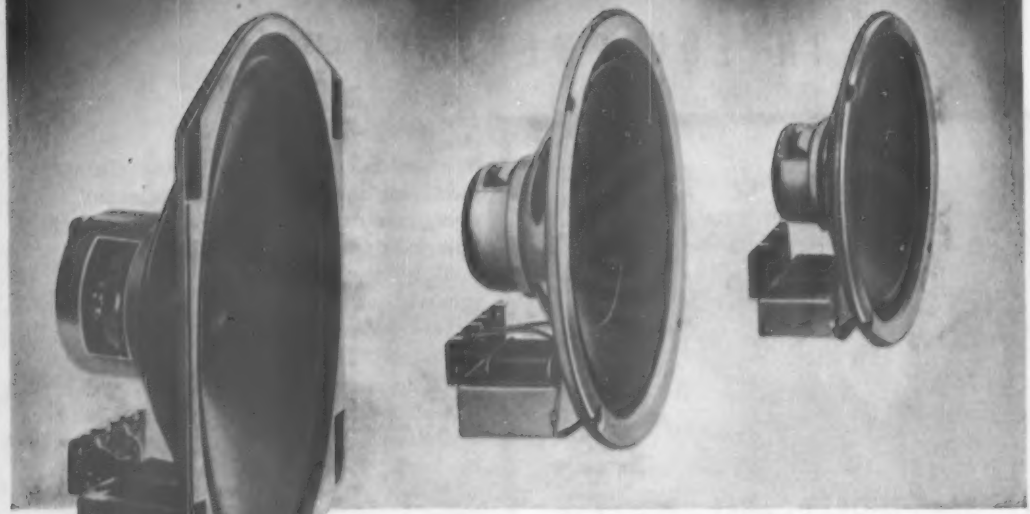
The holders are insulated from the panel which can vary from $\frac{1}{16}$" to $\frac{1}{8}$" thick. Thicker panels may be counterbored. Single hole mounting facilitates fitting. Rotation is prevented by flats on the body. The lamp can be replaced without breaking seals, by unscrewing cap.

Thorn

THORN ELECTRICAL INDUSTRIES LTD

AIRCRAFT COMPONENTS DIVISION, 105-109 JUDD STREET, LONDON, W.C.1

ELAC closed field...



...LOUDSPEAKERS

These loudspeakers have been designed to provide minimum magnetic interference together with high acoustic efficiency. ELAC Elliptical and round loudspeakers are used in most of the leading Television and Radio receivers.

PRICES INCLUDING P.T. FOR LOUDSPEAKERS LESS TRANSFORMER AS FROM NOV. 1st., 1954.

7" × 4" Elliptical	Flux 6,500 Gauss	21/10	6½" PM. 6G	Flux 6,500 Gauss	21/10
3½" PM. 3G	Flux 6,500 Gauss	19/10	8" PM. 8D	Flux 7,500 Gauss	29/1
5" PM. 5G	Flux 6,500 Gauss	20/6	10" PM. 10D	Flux 7,500 Gauss	34/4

ELAC

ELECTRO ACOUSTIC INDUSTRIES LTD.

Stamford Works, Broad Lane, Tottenham, N.15

PAINTON

By Appointment to the Professional Engineer

PAINTON "MULTICON" SERIES
6-POLE PLUGS & SOCKETS

'MULTICON'—Regd. Trade Mark PATENT 700999

VOLTAGE RATING 500 volts D.C. or A.C. Peak

CURRENT CARRYING CAPACITY 5 amps. D.C. or A.C. (RMS) per contact

Although in general the new Painton "Multicon" Series of Plugs and Sockets will be interchangeable with the existing Painton range, the 6-pole Plugs and Sockets have two contacts polarised to eliminate the possibility of 'wrong-way-round' insertion. In the 6-pole size (as on all other "Multicon" sizes when available) there is a complete variety of Plugs and Sockets with alternative mounting arrangements, cable fixings and retaining devices. The "Hammer-finish" silver-grey covers will blend with all equipments.

A low and constant contact resistance is achieved with the heavily silver-plated split contacts.

Any possibility of free moisture remaining between the Plug and Socket face is prevented because spacers keep the mating faces slightly apart, even when the Plugs and Sockets are fully engaged. The patented method of securing both the male and female contacts in the mouldings ensures the satisfactory operation of the Painton "Multicon" range under severe tropical and climatic conditions.

PLUG			SOCKET		
Cable Entry Top	Cable Entry Side	With Mounting Flange	Cable Entry Top	Cable Entry Side	With Mounting Flange
310009	310018	310007	310008	310029	310006
FITTED WITH LOCKING CLIP			FITTED WITH LOCKING CLIP		
311291	311292	—	311294	311295	—

PAINTON
Northampton England

A headache for somebody ...

It was a great little portable — but there just wasn't room for the battery. A bitter blow for the designer. Unless specially designed batteries were ordered, he would have to start again. Designers of battery radio sets should note this dilemma. Time, effort (and money) are wasted if you prepare a design and then find you haven't left room for the battery. Ever Ready are always able to make up special units but it's so much simpler to call us in early so that your set is designed, if possible, to take one of our many standard batteries.

EVER READY
REGD. TRADE MARK

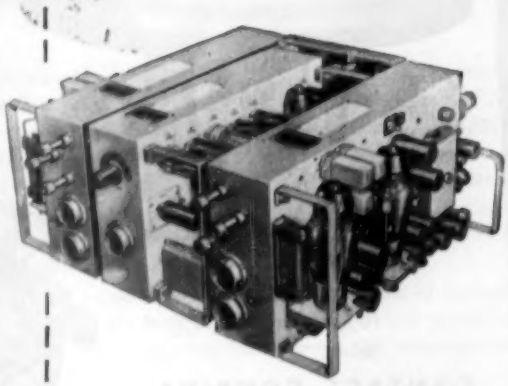
DRY BATTERIES FOR RADIOS

* *If you have a design problem involving dry batteries, get in touch with us at Hercules Place, Holloway, London, N.7 Telephone : ARChway 3030.*

. . . but for quantity production in electronics . . .

In the sphere of electronics, whatever you have to produce, whatever its state of development—if you want it produced quickly, in quantity, with commensurate quality; if you want it produced economically—it's a job for Plessey!

At the Electronics Division of Plessey, a thousand pairs of trained hands can, if need be, nurse a young idea—develop it—and bring it to full or limited production maturity with a thoroughness that would spell costly delay in any organisation less well equipped. The Division is presently engaged on contracts for for such renowned organisations as B.T.H., Decca, I.A.L., Kelvin Hughes, Marconi's Wireless Telegraph Company Ltd., and Laurence Scott & Electromotors Ltd. If your special interests lie in electronics, serve them well by writing for the Plessey publication which sets out the Division's specialised services.



Part of a particularly compact radar installation made for Marconi's Wireless Telegraph Company Ltd.

. . . you should see Plessey

ELECTRONICS DIVISION · TELEPHONE VALENTINE 8855

THE PLESSEY COMPANY LIMITED · ILFORD · ESSEX

PE 2a

RELAYS

SERIES 595 H

HERMETICALLY SEALED SERIES 595 H

This is a hermetically sealed version of our series 595 Relay, which is already well known to the aircraft industry.

The armature design reduces the effects of shock, vibration and acceleration ; a spring type armature hinge eliminates backlash, friction and risk of displacement.

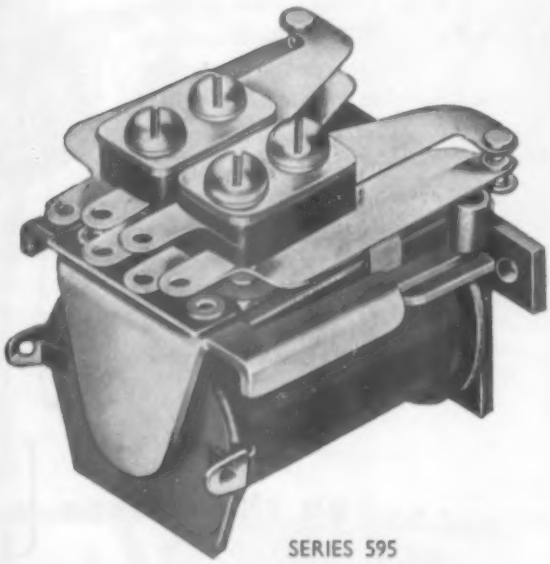
COIL: In all standard voltages up to 110 V. D.C. Working range between plus 10% and minus 20% of rating.

CONTACT COMBINATIONS: up to 2 pole changeover.

BASE: International octal.

WEIGHT: 3½ ozs.

DIMENSIONS :
Diameter—1 11/16" overall.
Height — 2⅛" overall.



SERIES 595

MAGNETIC DEVICES LTD
NEWMARKET

MD4A

A NEW-PRINCIPLE A-C AUTOMATIC VOLTAGE STABILISER

We have now had released to us by a Government Department the design of our "A.C. Mains Regulator, Automatic, Step, Mark II", and are therefore manufacturing this unit for general sale. It ideally fills the need for a cheap, small and light Stabiliser. Although it measures only 8½in. x 4½in. x 5in., weighs as little as 11 lbs., and costs only £24 net, it has a performance fully equal to any similarly rated Automatic Stabiliser of the resonated, saturated core type, without any of the disadvantages.

ASR-1150 has a pure output waveform, is unaffected by changes in mains frequency, and works equally well from no-load to full load, which is 1150 VA. It has a stabilised output at 230V unless otherwise ordered.

Many other Automatic Voltage Stabilisers are now manufactured by us, and all are available for immediate delivery. In some cases the constancy of output is as high as 0.15%. Models are available from 200 VA to 30 kVA, single phase. 3-Phase Stabilisers are also available. Prices are *extremely* competitive.

We can supply from stock all types of American tubes, condensers, valves, potentiometers, etc.

MEMO: If you are interested in infinitely-variable Transformers, do not forget the almost indispensable "VARIAC" (Reg'd. Trademark). Models are available from 170VA to 2kVA. Our Catalogue V-549 (3rd Edition) tells the whole story and will gladly be mailed free and post free, on request.

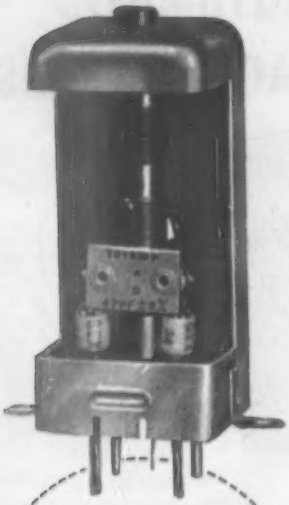
The *NEW "ASR-1150"* costs only *£24* net

Complete information is obtainable from:

CLAUDE LYONS LTD., STABILISER DIVISION,

HEAD OFFICES & WORKS: 76 OLDHALL STREET, LIVERPOOL 3, LANCS
SOUTHERN FACTORY: VALLEY WORKS, WARE ROAD, HODDESDON, HERTS.
(A10 main London/Cambridge Road, at Junction of A602)

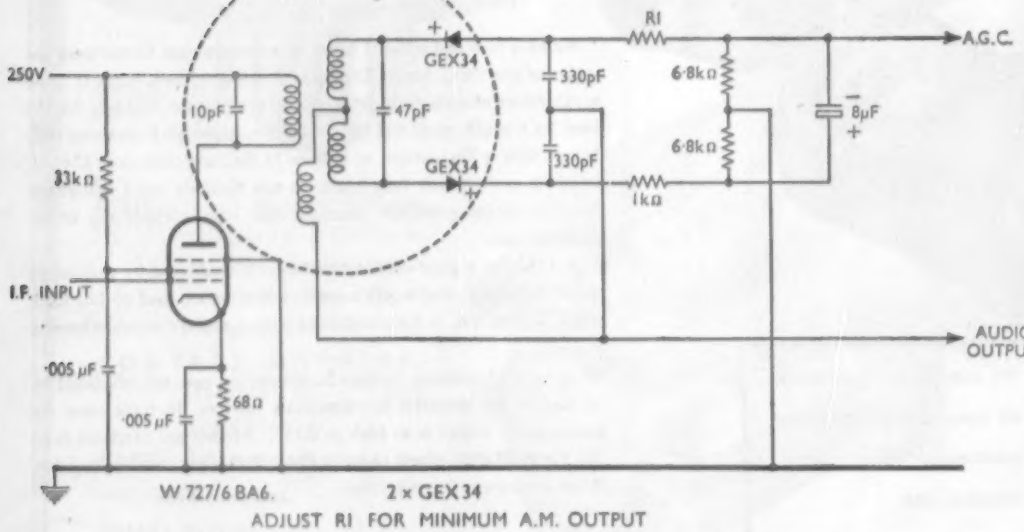
G.E.C. GERMANIUM DIODES



GEX 34 in the Ratio Detector

The Ratio Detector has been generally accepted as the most practical form of detector for receivers designed for the new High Quality F. M. Service to be inaugurated next year, since it obviates the need for a separate limiter stage.

The illustration shows the application of two GEX 34 in a typical ratio detector where full advantage has been taken of its small size by enclosing them in the I.F. transformer can. This construction reduces the risk of instability and eliminates the possibility of harmonic feed back via the heater leads.

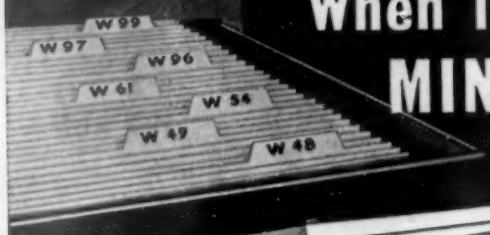


Transformer Design. Although the circuit shown above is conventional, an I.F. transformer designed for use with thermionic diodes is not necessarily the most suitable for germanium diodes. A suitable design of transformer has been evolved at The G.E.C. Research Laboratories, details of which are available on request.

Write to The Osram Valve and Electronics Department,

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, W.C.2.

When it's a question of MINIMUM SIZES...



HUNTS METALLISED PAPER CAPACITORS

HUNTS METALLISED PAPER CAPACITORS
MIDGET MOLDSEAL TUBULARS
TYPE W99

Specification

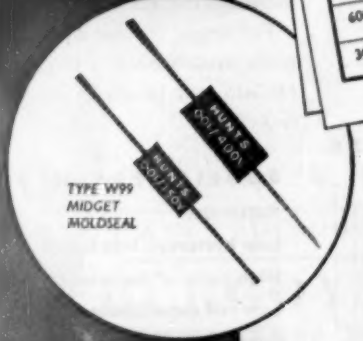
Heat moulded housing ensuring an adequate seal against moisture. Wire leads soldered directly to capacitor unit in a manner ensuring freedom from intermittent contact (strength of joint exceeds tensile strength of wire lead).

RANGES

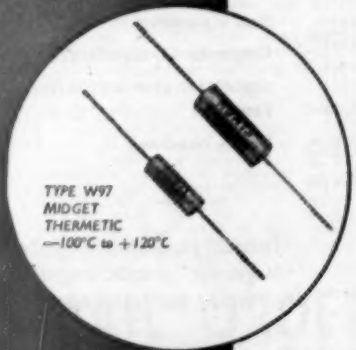
Working Voltage	Temperature Range	Capacitance μF	Size
150 D.C.	—40°C to + 71°C	0.004 to 0.01 0.02 to 0.04	A B
400 D.C.	—40°C to + 85°C	0.001 to 0.003 0.004 to 0.01	A B
600 D.C.	—40°C to + 85°C	50pf to 0.001 0.002 to 0.004	A B
300 A.C.	—40°C to + 71°C	50pf to 0.001 0.002 to 0.004	A B

SIZES "A = ⅜" x ¾" B = 1" x ⅝"

Capacitance Tolerance: Standard ± 20% (Closer tolerance available) Insulation Resistance: 20,000 megoh... working voltage... Power Factor ... than 2% at 1,0... per second at 20...



TYPE W99
MIDGET
MOLDSEAL



TYPE W97
MIDGET
THERMETIC
—100°C to + 120°C

Look to HUNTS!

For maximum reliability. Hunts capacitors for radio and electronic equipment include many types designed to meet the need of designers for decreased dimensions.

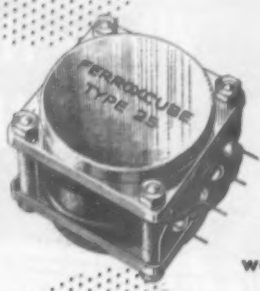
Type W99 listed above is just one example taken from Hunts unparalleled range of capacitors for every purpose.

Years of specialisation in nothing but capacitor design and manufacture has enabled us to achieve and maintain that long-lasting reliability, and outstanding performance which characterises every Hunt product.

Please write for leaflet giving full details of types for all applications.

REGISTERED TRADE MARK
HUNTS
CAPACITORS
THE TRADE MARK OF RELIABILITY

A. H. HUNT (Capacitors) LTD., WANDSWORTH, LONDON, S.W.18 BATtersea 1083-7
and in Canada • HUNT CAPACITORS (Canada) LIMITED, AJAX, ONTARIO



High Q inductance coils

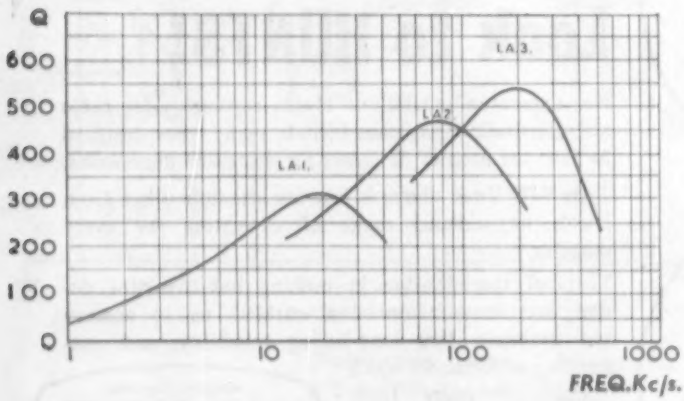
wound on Ferroxcube cores

DESIGNERS of compact and efficient tuned circuits and wave filters are making ever-increasing use of Mullard high Q inductance coils.

Based on Ferroxcube, the world's most advanced magnetic core material, these coils combine small size with an inductance of up to 30 henries over a wide frequency range. Furthermore, their convenient shape and self screening properties facilitate either individual mounting or stacking.

Full details of these and other high grade components now available from Mullard will be gladly supplied on request.

TYPICAL Q VALUES



Special Features

Small size

Low hysteresis loss factor

High value of inductance

Low self capacitance

Controllable air gap facilitating inductance adjustment

Self screening

Controlled temperature coefficient

Operation over a wide frequency range

Easily mounted

Mullard

'Ticonal' permanent magnets, 'Magnadur' ceramic magnets, Ferroxcube magnetic cores.

MULLARD LIMITED · COMPONENT DIVISION · CENTURY HOUSE · SHAFTESBURY AVENUE · LONDON · W.C.2
(MM450)

New The Editor SUPER TWO-SPEED TAPE RECORDER

A truly superb British-made recorder, rich in range and tonal qualities, for home and business recording. Its low price brings high fidelity recording within the reach of all. The "Editor Super" is sufficiently powerful to meet any volume requirement—sensitive enough to pick up the faintest whisper.

The "Editor Super's" range of tone, from maximum brilliance to a deep rich bass, IS IDEAL FOR PRE-RECORDED TAPES. It is simple in operation and has an unequalled smooth and reliable control. It is the latest addition to the Editor range of Recorders.

55 GNS.

(Carriage and Packing 15/-)

BUY ON THE M.O.S. PERSONAL CREDIT PLAN—10% deposit and balance over 6, 12, 18 or 24 months.

TECHNICAL SPECIFICATION

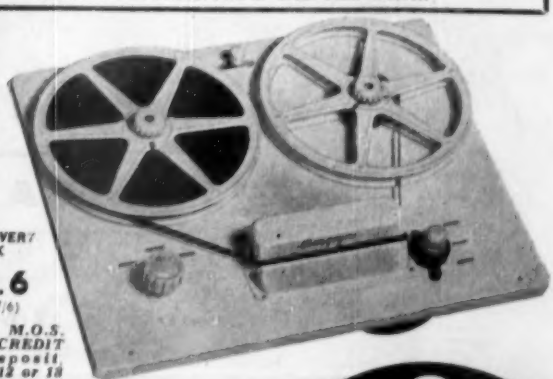
★ Recording sense to BBC, therefore suitable for pre-recorded tapes.
★ All leather suitcase with "continental" type of gilt locks and fittings. Detachable lid.
★ Completely self-contained, portable and compact. Overall size 16½in. x 12in. x 5in. (with lid 7in.). Weight 35lb.
★ Supplied complete with 1,200ft. high sensitivity standard Tape, and RONETTE desk microphone.
★ New design super tape deck powered by three recording motors with minimum wow and flutter.
★ Twin track recording GIVING TWO HOURS' PLAYING TIME AT 3¾in. per sec.
★ Single knob control mechanically and electrically interlocked.
★ MIXING AND MONITORING FACILITIES for separate Radio/Gram and microphone inputs.
★ Tonal balancing control.
★ Amplifier with overall negative feedback uses miniature Mullard valves. May be used independently for P.A. or high fidelity reproduction.
★ Recording level meter by magic eye.
★ Brilliant reproduction from 5in. high flux P.M. speaker. 4 watts output.
★ L.S. Extension sockets and muting switch.
★ Uniform frequency response between 40-10,000 c/s. at 7½in. per sec.
★ Fast forward and fast rewind without unlacing tape, and accidental erasure made impossible by simple fully automatic control.
★ Drop-in Tape loading.
★ Positive and instantaneous servo braking of all functions.
★ For A.C. Mains 200-250 v. 50 c/s.

The "EDITOR" at 45 Gns. is still the lowest priced quality tape recorder.
Available on the M.O.S. Personal Credit Plan, as above.

BURGOYNE

2-SPEED TAPE DECK

Here is the heart of your Tape Recorder. If you are building or modernising your own equipment, you MUST have the latest BURGOYNE Tape Deck giving 2 speeds, designed for building into complete recorders.



BRIEF SPECIFICATION

★ 2 HOURS' PLAYING TIME. ★ Automatic speed change. ★ Drop in Tape Loading. ★ Instantaneous and positive braking. ★ Minimum wow and flutter. ★ Frequency range 50/10,000 c/s at 7½in./sec. ★ Powered by 3 high-grade motors. ★ Twin-track high impedance heads. ★ Fast forward and rewind without unlacing tape. ★ Overall size 11¼in. × 14¼in. ★ For 200/250 v. A.C. Mains.

IMMEDIATE DELIVERY FROM STOCK

£13.19.6

(Carr & packing 7/6)

BUY ON THE M.O.S. PERSONAL CREDIT PLAN—10% deposit balance over 6, 12 or 18 months.

E. & G. MAIL ORDER SUPPLY CO. M·O·S

The Radio Centre

33, Tottenham Court Road · London · W.1 · Tel. MUS 6667

VISUAL VALVE TESTER

This equipment displays on a cathode-ray tube a family of Ia/Vg curves for any receiving type thermionic valve. Eleven curves corresponding to eleven different grid voltages are presented simultaneously and a calibrated graticule permits rapid comparison with published data.

Nine standard valve bases are provided, with facilities for connecting others, and the various valve electrodes are connected to the requisite supplies by a multi-button switching board.

This permits any electrode to be connected to any supply without damage and also enables electrodes to be paralleled for test purposes.

All external parameters Va, Vs, Vh, Vg, are continuously variable over a wide range and current and voltage values are metered.
Full technical data is available on request.

CINEMA TELEVISION LTD

A COMPANY WITHIN THE J. ARTHUR RANK ORGANISATION

WORSLEY BRIDGE ROAD · LONDON · S.E.26
HITHER GREEN 4600

SALES AND SERVICING AGENTS:
Hewnt & Co. Ltd., 59 Moor St. Birmingham, 4
Atkins, Robertson & Whiteford Ltd., 100 Torrisdale Street, Glasgow, S.2
F. C. Robinson & Partners Ltd., 122 Seymour Grove, Old Trafford, Manchester, 16

FERRANTI

CATHODE RAY TUBES

A wide range of Cathode Ray Tubes and Valves for industrial and domestic use is manufactured by the Electronics Department. 14" and 17" Rectangular Tetrode Cathode Ray Tubes with Aluminized screens and 6·3 volt, 0·3 amp. heaters are available.

Enquiries to Electronics Dept., Moston, Manchester, 10.

SMALL HERMETICALLY SEALED INSTRUMENTS

Ferranti 2", 2½" and 3½" Hermetically Sealed Instruments for Service requirements are available in both moving coil and moving iron types for current and voltage measurement.

Enquiries to Instrument Sales Dept., Moston, Manchester, 10.

FERRANTI

FERRANTI LTD · MOSTON · MANCHESTER 10

Head Office and Works: HOLLINWOOD · LANCS

London Office: KERN HOUSE, 36 KINGSWAY, W.C.2.

FG179

Hi Fi HIGH FIDELITY AMPLIFIER

The PF91 amplifier, with the PF91A remote control unit, is a versatile and practical combination for those who demand realism in sound reproduction from record players, tape recorders, microphones or radio tuners.

Substantially flat frequency range from 20-20,000 c.p.s., up to 12 watt output.

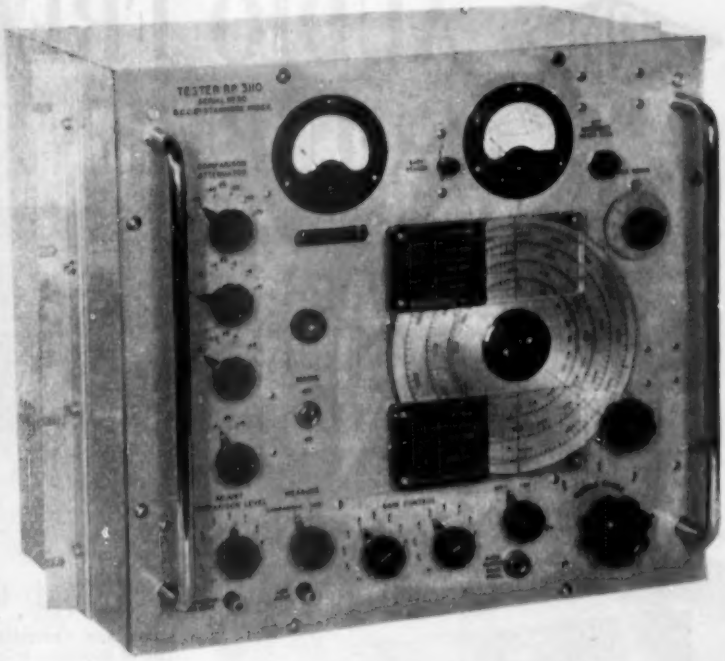
National Physical Laboratory confirms our claims for this amplifier.

MODEL PF91
28 GNS
MODEL PF91A
12 GNS

Demonstrations of the PF91 can be arranged through Pye Hi-Fi agents. Please write for a fully illustrated booklet to Pye Limited, Box 49, Cambridge.

PYE LIMITED OF CAMBRIDGE

TEST SET R.P. 3110



A transportable and self contained instrument which provides all the facilities required for measuring the level of a selected signal in the presence of signals of different frequencies.

TECHNICAL DATA

Frequency range: 60 Kc/s to 3,000 Kc/s.

Through or terminated levels, using probe at a point distant from the Tester:—
from +10 db to −61.5 db, reference level 1 mw in 75 ohms.

Terminated levels, signals applied directly to Tester:—
from +10 db to −81.5 db, reference 1 mw in 75 ohms.

Dimensions: 17" wide, 15¾" high, 12" deep.

Weight: 75 lbs.

Power supply: 200-250V. A.C. 50 c.p.s. consumption approx. 70 watts.

AVAILABLE FROM STOCK

BRITISH COMMUNICATIONS CORPORATION LIMITED

Second Way, Exhibition Grounds, Wembley, Middlesex · Telephone: Wembley 1212

AIRMEC

AUDIO FREQUENCY EQUIPMENT

POWER OUTPUT METER Type 708

Output powers from 1 milliwatt to 20 watts may be measured by this instrument, in the frequency range 30 c/s to 30 kc/s. No tapped matching transformer is used, and the input impedance remains resistive and constant over the whole frequency range.

Power Range: 1 milliwatt to 20 watts in 4 ranges.
Frequency Range: 30 c/s—30 kc/s.
Input Impedance: 2, 4, 7, 10, 15, 20, 40, 75, 100, 140, 250, 400, 600, 1,000, 2,000, 3,000, and 5,000 ohms.
Accuracy: ± 10% of full scale power from 30 c/s to 15 kc/s. The meter reading is approximately 1 db low at 30 kc/s.
Price and Delivery: £40 Ex Stock.

L.F. SIGNAL GENERATOR Type 702—

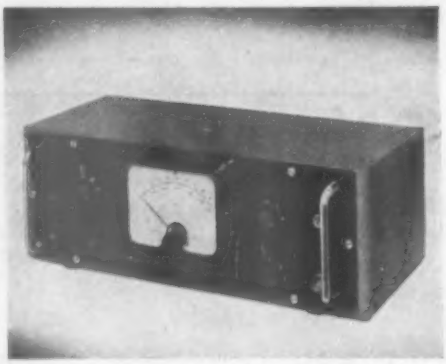
This Signal Generator utilises a resistance-capacitance type of oscillator to provide stable, accurate and easily controlled voltages in the frequency range 30 c/s—30 kc/s. A screened and balanced output transformer and attenuator enable unbalanced, balanced and floating outputs to be obtained from a source of constant 600 ohm impedance.

Frequency Range: 30 c/s—300 c/s, 300 c/s—3 kc/s, 3 kc/s—30 kc/s
Stability: ±0.05%, ±0.5 c/s.
Attenuator: A 600 ohm constant impedance attenuator provides steps of 20, 40 and 60 db of attenuation under all output conditions.
Price and Delivery: £75 Ex Stock.

FREQUENCY METER Type 726

This instrument indicates directly on a large scale meter, the frequency of any repetitive electrical waveform of amplitude between 0.1 and 20 volts, over the range 20 c/s to 20 kc/s. When used as a tachometer, measurement of speeds of rotary or reciprocating movements may be made up to 1,200,000 r.p.m. without loading the mechanism under test in any way.

Frequency Range: 0–200 c/s, 0–12,000 r.p.m.
0–2,000 c/s, 0–120,000 r.p.m.
0–20,000 c/s, 0–1,200,000 r.p.m.
Accuracy: ± 1% of f.s.d.
Power Outputs: Output Voltages are available for operating Airmec Photocell Equipment.
Price and Delivery: £65 Ex Stock.

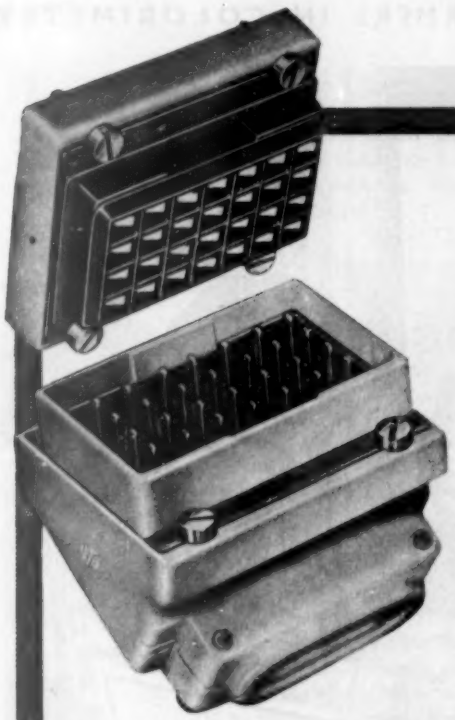


Full details of these or any other Airmec instruments will be forwarded gladly upon request.

AIRMEC LIMITED

HIGH WYCOMBE — BUCKINGHAMSHIRE

Telephone: High Wycombe 2060 *Cables:* Airmec High Wycombe



A PROVED RANGE OF MULTI-WAY PLUGS AND SOCKETS WITH UNUSUALLY LOW INSERTION PRESSURES.

——— Multi-way Plugs and Sockets with years of experience and application behind them. When specifying these high quality components you will be assured of less insertion pressure per contact than any comparable product can offer, great versatility, and suitability for humid conditions. For rack mounting applications greater latitude in matching up eases the designers problem, and the range of 4, 8, 12, 20 and 28 way units will be found to cover almost every requirement. Widely used by such manufacturers of high quality equipment as:

Messrs. Marconi's Wireless Telegraph Co. Ltd.
Messrs. Standard Telephones & Cables Ltd.
The English Electric Co. Ltd.

Full details will be gladly supplied upon request.

POWER CONTROLS

LIMITED

EXNING RD., NEWMARKET PHONE: NEWMARKET 3181

CONSTANT VOLTAGE TRANSFORMERS IN COLORIMETRY

-but COLOUR MATCHING to-day

depends upon

CONSTANT VOLTAGE....

In 1955 electronics provides the answer. In colour matching to-day, the precision instruments used must have a reliable and constant voltage supply, and this is one of the many applications Advance Constant Voltage Transformers fulfil so effectively.

Full details given in folder W/28 gladly sent on request.

Advance
CONSTANT VOLTAGE TRANSFORMERS

CVT

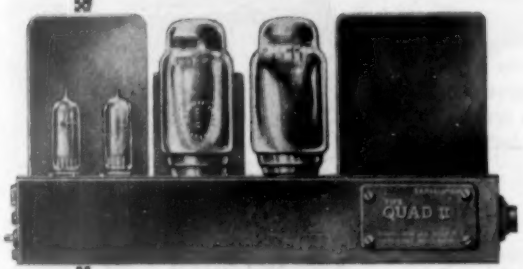
ADVANCE COMPONENTS LTD.
MARLOWE ROAD, WALTHAMSTOW, LONDON, E.17
Telephone : LARkswood 4366

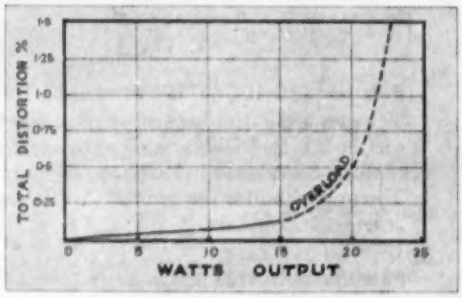
GD

There are those who consider that there is little to choose in the range of power amplifiers now available—perhaps because the power amplifier is usually considered the "easy" part in the search for audio perfection. Why is it then that leading engineers are so enthusiastic about the QUAD II design?

. . . on feedback and linearity

They like the unique integrated feedback to provide complete stability independent of phase changes in the load current . . . the method used for eliminating the loop gain outside the audio range without prejudice to the input signal . . . the way that feedback is again used to provide optimum design stage by stage and to control the effective time constants. They like its use yet again to provide a unique self-balancing phase changer without the usual assymetry to the H.T. line. They like, too, the fact that the specification is fully met with commercially tested valves without matching or alignment of any kind. They extol the conservative ratings and restoration from overload (several nation-wide broadcasting corporations officially uprate the output to 20 watts, since with this degree of overload, distortion is still well within their acceptance figures).





Linearity and overload of the QUAD II amplifier

Good engineering for the best performance* also results in greater efficiency. Compare the size of the QUAD with any other amplifier of approaching specification. Note the size of the output transformer which results from optimum choice of flux and core material to suit design requirements.

The QUAD II power amplifier is primarily designed as part of the complete QUAD II amplifier. The power amplifier is also supplied separately as a quality standard when with a suitable input transformer it can be fed direct from a 600 ohm line.

* The unique output stage design principles are discussed in *Wireless World*, September, 1952.

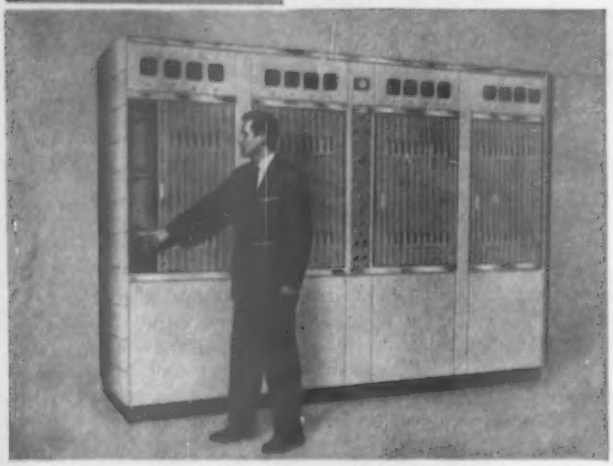
The QUAD II is available throughout the world. Fully stocked servicing organisations are now operating in Canada, throughout U.S.A., Panama, Canal Zone Trinidad, Jamaica Venezuela, Australia Malaya, Singapore, Japan, Hong Kong, Burma, India, Ceylon, Pakistan, South Africa, Portugal, Italy France Switzerland, Belgium, Norway and Sweden.

ACOUSTICAL MANUFACTURING CO LTD

ACOUSTICAL MANUFACTURING CO. LTD., HUNTINGDON, ENGLAND

Now—far ahead of its time—Great new 10KW Short Wave Transmitter!

32 new, special features that won't be matched for years — now available in new RCA BHF-10A Broadcast Transmitter!



Front view of BHF-10A transmitter reveals handsome, functional design. Requires only 33 sq. ft. of floor space.

Puts the INVESTOR far ahead!

Years-ahead engineering makes the new RCA 10KW transmitter an exceptionally sound investment. Installation costs are low, for this self-contained transmitter can be installed in existing buildings without alteration. Maintenance has been simplified—and routine operation can be handled by non-technical personnel!

Puts the BROADCASTER far ahead!

The new BHF-10A has sufficient power to cover large service areas; quick frequency change, to increase usefulness; unsurpassed reliability, for unbroken service. The opportunities for commercial stations to increase revenue are *built in!*

Puts the ENGINEER far ahead!

Here are just a few advantages for the *engineer:* easy maintenance, through use of a limited number of high-gain tubes. *Air* cooling. Simplest tuning. Electronically protected circuits — and full power for zonal broadcasting in 90, 75 and 60 metre bands, and international broadcasting over a frequency range of 3.2 – 26.1 mc.

These are just a few of 32 special features of this RCA transmitter that ushers in a new era of radio — proud achievement of RCA's 30 years of broadcast pioneering. Write today for booklet giving complete specifications!

Rear view, power output section showing PA tuning and output coupling unit.

RCA INTERNATIONAL DIVISION

RADIO CORPORATION of AMERICA

RCA BUILDING

30 ROCKEFELLER PLAZA, NEW YORK, N.Y., U.S.A.

TMKS. ®

THE ADVERTISEMENT

WE DIDN'T WRITE OURSELVES

The leading experts and users all over the world wrote it for us!

F. J. CAMM
Editor of 'Practical Wireless' and 'Practical Television'

JOHN GILBERT
of Northern Polytechnic and of B.B.C. Inventors' Club

P. WILSON
Technical Editor, 'The Gramophone'

H. J. BARTON-CHAPPLE
Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., M.I.E.E., Hon. M.Brit. I.R.E.

L. ORMOND SPARKES
Radio Consultant and Designer

Prov. Patent 10037/53

CAMBRIC CONE

Stentorian

HI-FI UNITS

Every claim we have made for these remarkable units has been substantiated by experts and users—they have produced the largest volume of unsolicited testimony ever known in the history of loudspeaker manufacture.

From every part of the world we are told that the quality of reproduction is unrivalled except at many times the price—that these units have enabled everyone to enjoy High Fidelity at realistic cost. We are truly grateful for this amazing response.

Points to note: patented Cambric Cone, high flux density Alcomax magnet, die-cast chassis, Universal impedance speech coil (at 3, 7.5 and 15 ohms) on 8, 9 and 10 inch models. Prices from **37/6** to **£9.15.6** (tax paid).

Ready-to-assemble Base Reflex Console Cabinet for 10" or 12" unit £10.10.0.
Corner Console Cabinet for 8" unit £5.10.0.

Write for descriptive leaflets, or ask your usual dealer to demonstrate. Alternatively, these and other Stentorian speakers may be heard at our London Office (109 Kingsway, W.C.2) any Saturday from 9 a.m. to noon.

WHITELEY ELECTRICAL RADIO CO. LTD
MANSFIELD · NOTTS

Ronette

type "RFC" Studio microphone

A Ronette "Filtercel" microphone with the fine contours of a studio type unit, having glossy black grilles fitted in chrome plated frame. Available with several types of "Filtercel" cartridges. For use with long lines a special model with built-in line transformer is obtainable.

Further information regarding these microphones and other Ronette devices will be gladly supplied upon request.

TRIANON ELECTRIC Ltd. LONDON NW10

95, Cobbold Rd., Willesden Telephone Willesden 2116

FAMOUS MICROPHONES

NEW ARCOLECTRIC SIGNAL LAMPS

For Low Voltage or Mains

Illustrated are a few signal lamps taken from our wide range. The insulation of every Arcolectric signal lamp will resist a flash test of 1,500 volts A.C.

The S.L.90 illustrated here is a typical Arcolectric low voltage signal lampholder. It is designed to accept popular M.E.S. bulbs. The bulb is accessible from front or rear of panel. The domed plastic lens surrounded by a polished chrome bezel gives a most attractive panel appearance. This holder can be fixed in a single $\frac{3}{4}$" hole.

The mains voltage signal lamp S.L.88/N is supplied complete with an M.E.S. neon tube and a suitable series resistance.

S.L.88/N

S.L.90

S.L.86

S.L.82

S.L.92

Write for Catalogue No. 128

ARCOLECTRIC SWITCHES · LTD

CENTRAL AVENUE. WEST MOLESEY, SURREY · TELEPHONE: MOLESEY 4336 (3 LINES)

FOR FULL DIMENSIONAL SOUND

THE

Concertone

48 GNS COMPLETE

MAGNETIC RECORDER

Abridged Specification

Tape speeds, 7½in. and 3¾in./sec. Fast Forward and Rewind. Self-compensating Servomatic brakes. Single slot loading. Position scales. Inputs Mic., Rad. and Gram. Frequency response 7½in./sec. 50-12,000 cps. within 3db. 3¾in./sec. 50-6,000 cps. within 5db. Bias freq., 51 kc/s. Half track recording. Interlocked controls Wow .02% max. Recording to International Standard. Cabinet—Blue and Grey rexine. Storage for Mic. and Mains lead. Detachable lid. Gross weight, 26 lbs. For 210/250 v. A.C. ONLY.

Meticulously recording *every tonal facet* with *complete mastery*, the "Concertone" tape recorder will give you the *ultimate listening pleasure* that comes from superb music *faultlessly* recorded and reproduced.

The "Concertone" will re-create, in the home, the *true image* of the *original performance*. Whether it be Solo Violin, or Oboe, or a Full Organ with its demanding power and range, the "Concertone" with its *wide frequency response*, and *extended dynamic range*, will satisfy the *connoisseur* of fine music.

Simple, absolutely reliable, rugged, compact, lightweight, and easily portable, the "Concertone" will, wherever there are sounds to be recorded, *serve faithfully*, earning, justly, *unqualified praise* for its *faultless performance*.

Manufactured by the company in its own precision machine shop, the tape mechanism employs three motors and a special design servomatic brake. The brake not only locks the spools *securely* during transit, but of greater importance, it is *completely free from fade*, being *self-compensating* for wear. Unique is the provision of a *mechanical interlock* which prevents faulty operation.

SEE YOUR DEALER TODAY AND JUDGE THIS FINE MACHINE FOR YOURSELF. IN THE EVENT OF DIFFICULTY SEND DIRECT FOR A COMPREHENSIVE SIX-PAGE LEAFLET (please enclose a s.a.e.).

Trade enquiries cordially invited

FISHER ELECTRONICS COMPANY LTD.

70, BREWER ST., LONDON, W.1. Phone: GER 3376

EXPORT ENQUIRIES TO :— THE BARNETT SHIPPING & EXPORT CO. LTD., 25 MONMOUTH ST. LONDON E.C.3.

MULTITONE

SPECIALIZE
in equipment for the DEAF
and for PHYSIOTHERAPY

The ADAPHONE

enables the deaf to hear TV and Radio programmes in comfort and safety and with a clarity unobtainable when using a hearing aid for this purpose. It is also ideal for those with normal hearing who wish to hear the programmes without disturbing others.

The Adaphone has an attractive grey plastic case (3in. x 2in. x 1¼in.). Weighted straps hold it in position on any chair arm. The input is matched for 2 to 10 ohms connection and the transformer tested to withstand 2,000 volts D.C. The listener can adjust the volume to his individual need without affecting the loudspeaker volume.

Tone control is obtained by alternative output sockets; 'Normal' and 'High.'

The M3 model has Automatic Volume Compression.

A low-impedance insert-type magnetic miniature receiver of D.C. resistance 30-40 ohms is supplied, but a bone-conduction receiver is available instead, at extra cost, for those who prefer it.

MODEL M4. Complete with miniature earpiece, standard earmould, and leads..... £4 19 0

MODEL M3. Incorporating Automatic Volume Compression, complete as above..... £5 15 0

MODEL M5. Incorporating Loudspeaker Switch for 'silent' listening £5 15 0

Obtainable through all leading Radio Dealers or direct from Multitone Electric Company Limited.

Inquiries should be addressed to
MULTITONE ELECTRIC CO. LTD.
223-227 St. John Street, London, E.C.1.
PIONEERS IN SOUND AMPLIFICATION

MAINS TRANSFORMERS

FULLY INTERLEAVED
SCREENED AND IMPREGNATED. ALL GUARANTEED

ALL PRIMARIES ARE 200/250 v. Half Shrouded.

MSM63 (Midget). Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps. 16/3
MS63. Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps. 16/6
MS40. Windings as above. 4 v. at 4 amps., 4 v. at 2 amps. 16/6
Output.
MS2. 250-0-250 v. 80 m/a. 19/-
MS3. 350-0-350 v. 80 m/a., 19/-. **MS30.** 300-0-300 v. 80 m/a. ... 19/-
MS2X. 250-0-250 v. 100 m/a., 21/-. **MS75.** 275-0-275 v. 100 m/a. 21/-
MS30X. 300-0-300 v. 100 m/a., 21/-. **MS3X.** 350-0-350 v. 100 m/a. 21/-

Fully Shrouded

FSM63 (Midget). Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. 2 amps. 16/9
Output
FS2. 250-0-250 v. 80 m/a. 21/-
FS30. 300-0-300 v. 80 m/a., 21/-. **FS3.** 350-0-350 v. 80 m/a. ... 21/-
FS2X. 250-0-250 v. 100 m/a., 23/-. **FS75.** 275-0-275 v. 100 m/a. 23/-
FS30X. 300-0-300 v. 100 m/a., 23/-. **FS3X.** 350-0-350 v. 100 m/a. 23/-
All the above have 6.3 4-0 v. at 4 amps., 5-4-0 v. at 2 amps.
FS43. Output 425-0-425 v. 200 m/a., 6.3 v. 4 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded 47/6
FS58. Output 450-0-450 v. 250 m/a., 6.3 v. 2 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded 67/6
FS5X. Output 350-0-350 v. 250 m/a., 6.3 v. 6 amps., 4 v. 8 amps., 4 v. 3 amps., 0-2-6.3 v. 2 amps. Fully shrouded 65/-
FS160X. Output 350-0-350 v. 160 m/a., 6.3 v. 6 amps., 6.3 v. 3 amps., 5 v. 3 amps. Fully shrouded 44/-
FS43X. Output 425-0-425 v. 250 m/a., 6.3 v. 6 amps., 6.3 v. 6 amps., 5 v. 3 amps. Fully shrouded 63/6
HS6. Output 250-0-250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. For receiver R1355. Half shrouded 26/6
HS150. Output 350-0-350 v. 150 m/a. 6.3 v. 3 amps., C.T. 5 v. 3 amps. Half shrouded 27/9
F36. Output 250-0-250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. Fully shrouded 29/6
FS128. Output 350-0-350 v. 120 m/a., 6.3 v. 2 amps., C.T. 6.3 v. 2 amps., C.T. 5 v. 3 amps. Fully shrouded 29/9
FS256. Output 250-0-250 v. 80 m/a., 6.3 v. at 6 amps. 5 v. at 3 amps. Fully shrouded 28/6
PR1/1. Output 730 v. at 30 m/a., 6.3 v. at 1.5/2 amps. 21/-
PS150. 350-0-350 v. 150 m/a., 6.3 v. 4 amps., 5 v. 3 amps. 31/6
FS150X. Output 350-0-350 v. at 150 m/a., 6.3 v. at 2 amps., C.T. 6.3 v. at 2 amps., C.T. 5 v. at 3 amps. Fully shrouded..... 31/6
The above have inputs of 200/250 v.

OUTPUT TRANSFORMERS

MIDGET OP. 5,000Ω to 3Ω 3/9
8,000Ω to 3Ω 3/9
OP10. 10/15 watts output. 20 ratios on Full and Half Primary... 17/9
OP30. 30 watts output, 20 ratios on Full and Half Primary 25/9
Williamson's O.P. Transformer to Author's specification... £4/13/6
Chokes for Williamson's Amplifier, 30 H. at 20 m/a. 16/6
10 H. at 150 m/a. 32/-

FILAMENT TRANSFORMERS
All 200/250 v. Input.

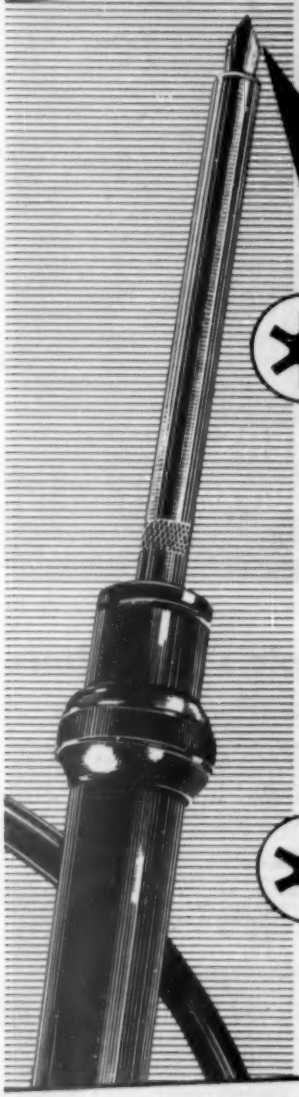
F3. 6.3 v. @ 3 amps. 9/6
F4. 4 v. @ 2 amps., 7/6. **F6.** 6.3 v. @ 2 amps. 7/6
F6X. 6.3 v. @ 0.3 amps., 5/6. **F12X.** 12 v. @ 1 amp. 8/-
FU6. 0-2-4-5-6.3 v. @ 2 amps., 10/-. **F12.** 12.6 v. tapped 6.3 v. @ 3 amps. 16/6
F24. 24 v. tapped 12 v. @ 3 amps. 23/6
F29. 0-2-4-5-6.3 v. @ 4 amps., 18/9. **FU12.** 0-4-6.3 v. @ 3 amps. 17/6
FU24. 0-12-24 v. @ 1 amp. 17/6
F5. 6.3 v. @ 10 amps. or 5 v. @ 10 amps., or 12.6 v. @ 5 amps., or 10 v. @ 5 amps. 24/-
F6/4. Four windings at 6.3 v. tapped 5 v. @ 5 amps. each, giving by suitable series and parallel connections up to 6.3 v. @ 20 amps. 51/6

Quotations, etc. stamped addressed envelope, please.
C.W.O. (add 1/6 in £ for carriage).

Export enquiries invited.

H. ASHWORTH (Dept. W.W.),
676, Gt. Horton Road, Bradford 7, Yorks.

m-i-n-u-t-e-s *into seconds...*



with the brilliant NEW

Superspeed SOLDERING IRON

MANUFACTURED FOR ENTHOVEN SOLDERS LTD. BY SCOPE LABORATORIES, MELBOURNE, AUSTRALIA

STAR FEATURES

★ Heats up from cold in 6 seconds—by a light thumb pressure on the switch ring.

★ When not in use, current is automatically switched off—thus greatly reducing wear of copper bit. Electricity consumption is correspondingly reduced.

★ It is 10" long, weighs 3½ ozs., can be used on 2·5 to 6·3-volt supply. 4-volt transformer normally supplied.

★ More powerful than conventional 150-watt irons and equally suitable for light wiring work or heavy soldering on chassis.

★ Simple to operate, ideal for precision work. Requires minimum maintenance at negligible cost. Shows lowest operating cost over a period.

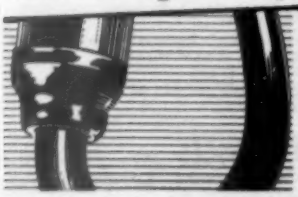
★ Can be used from a car battery.

★ It is by far the most efficient and economical soldering iron ever designed for test bench and maintenance work.

STAR APPLICATIONS

Designed on an entirely new principle, this light-weight, versatile iron is eminently suitable for soldering operations in the RADIO, TELEVISION, ELECTRONIC and TELECOMMUNICATION industries, particularly for all SERVICE work. For general purpose work the Superspeed Iron is the ideal stand-by soldering tool.

The **Superspeed** *soldering iron is available* **NOW**



Write for full particulars, including guarantee terms and free trial facilities, to the sole concessionaires in this country—

ENTHOVEN SOLDERS LIMITED

(Industrial Equipment Division), 89 Upper Thames St., London, E.C.4. Telephone: MANsion House 4533

LIST PRICES Subject to trade discounts.	
Superspeed Soldering Iron	39/6
Transformer (optional)	31/6
Replacement Element	1/-
Replacement Copper Bit	10d.

Panton

A SOUND TIE UP
A.I.D APPROVED
"WILLESDEN" TRANSFORMERS
for all
ELECTRONIC & TELECOMMUNICATION REQUIREMENTS
WILLESDEN TRANSFORMER CO. LTD., 2a, FRITHVILLE GARDENS, SHEPHERDS BUSH, LONDON, W.12. Telephone: SHE 5819, 2714.

- T/V TECHNOLOGY
- RADIO ENGINEERING
- ELECTRONICS
- RADIO SERVICING

There's a big future in T.V and Radio. Act now! Increase your knowledge. Back up experience with a sound theoretical background. I.C.S. offer courses of instruction in—

T.V TECHNOLOGY ● ADVANCED SHORT-WAVE RADIO ● RADIO ENGINEERING ● RADIO SERVICE ENGINEERING ● RADAR ● BASIC ELECTRONICS. FREQUENCY MODULATION.

I.C.S. will also coach you for the following examinations:— **B.I.R.E.; P.M.G. Certificate for Wireless Operators; Radio Servicing Certificate (R.T.E.B.); C. & G. Telecommunications, etc., etc.**

DON'T DELAY—SEND COUPON TODAY for free descriptive booklet, stating which subject or examination interests you. Fees include all books needed. Examination students coached until successful.

Reduced terms for H.M. Forces.

Dept. 223D, I.C.S., 71 Kingsway, W.C.2.

INTERNATIONAL CORRESPONDENCE SCHOOLS. Dept. 223D, International Buildings, Kingsway, London W.C.2.

Please send Booklet on subject.....

Name ..... Age.....
(Block letters, please)

Address .....

ICS

Other People's Amplifiers
and Radio Feeder Units

If any reader should have his mind set on a high priced amplifier of another make but would like to save some money if possible, we should like to make the following clear-cut offer: If he buys one of our Symphony Amplifiers (Standard or Decca or Studio version) and is not entirely satisfied with it he may return it for full credit against *any other amplifier on the market*. It should be emphasised at this stage that as Retailers we can supply any amplifier or Radio Tuner advertised in the "Wireless World" or "Gramophone."

GOODMANS CORNER CABINETS (right) for the AXIOM 150 Mark 2 manufactured by us to Messrs. Goodmans' measurements. Height, 44in. Price: complete kit in plain board with 1in. thick felt, 8 gns Price ready built, **10 gns.** Finished in figured walnut, **16 gns.** Other veneers to order. Carriage extra according to area.

FREQUENCY MODULATION TUNER UNITS

We have carefully tested the few makes of F.M. Tuners on the market at present and are pleased to be able to recommend and supply the following:

CHAPMAN Model FM81. Tuneable Model with attractive facia panel and dial. Will provide amazing degree of realism with complete absence of background noise when working with the N.R.S. No. 2 Symphony Amplifier or other high grade amplifier. Price £31. Call for a demonstration or send for leaflet.

TAPE DECKS AND AMPLIFIERS

ELPICO Tape Deck as per "Impressario" Recorder, push-button controls, high-fidelity heads. Price **19 gns.**

TAPE AMPLIFIER as per "Impressario" Recorder. Separate Treble and Bass controls, neon level indicator. Price **19 gns.**

TRUVOX Tape Deck Mark III. Price **22 gns.**

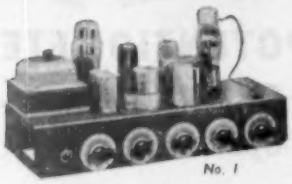
TAPE AMPLIFIER TYPE C, expressly designed by Truvox to work perfectly with their Deck. 3 valves plus rectifier and Magic Eye level indicator. Price **16 gns.**

NORTHERN RADIO SERVICES Phone: PRimrose 8314
11 KINGS COLLEGE RD., ADELAIDE RD., LONDON, N.W.3
Tubes: Swiss Cottage or Chalk Farm

REAL HIGH FIDELITY *at modest cost . . .*

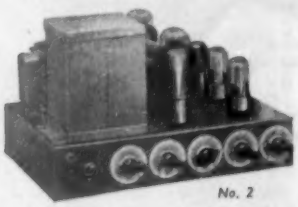
•Manufacturer-to-Consumer policy saves you at least one-third cost!

We are now specialising in the supply of units for making up high-fidelity Radio and Record-reproducing Equipments for use in the Home small Halls, Schools and Gramophone Societies and single items for replacing in existing equipments and radiograms.
Our Chief Engineer, who is operating a Technical Guidance Service, is available daily, including Saturdays, from 10 a.m. to 6 p.m., or will deal with enquiries by return of post. Our new illustrated Catalogue and Supplement will be a great boon to those desiring high quality equipment for modest expenditure. Send two 2½d. stamps for your copy now. It may well save you pounds.



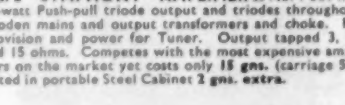
No. 1

No. 1 "SYMPHONY" AMPLIFIER is a 3-channel 5-watt Gram/Radio Amplifier with astonishingly flexible tone control. You can lift the treble, the bass, or—and here is the unique feature—the middle frequencies to suit your own ear characteristics and the record or radio programme being heard. It is thus possible to arrange the frequency-response of the amplifier to a curve equal and opposite to the resultant curve of the other items in the chain so that what finally registers in the brain is as per original. This flexibility of control is far more important than mere nominal linear response of the amplifier, as the pick-up, speaker, etc., are not linear. Independent Scratch-Cut is also fitted and special negative-feedback circuit employed. The Amplifier can accommodate a wide variety of records from old 78's to new L.P.'s. Input is for all types of pick-up of 0.1 v. output or more and there is full provision (and power) for Radio Tuner. It is available to match 2/3 or 15 ohms speakers. Price: **10 gns.** (carriage 5/-). Fitted in portable Steel Cabinet, **35/- extra.**



No. 2

No. 2 "SYMPHONY" AMPLIFIER as No. 1 but with 10-watt Push-pull triode output and triodes throughout. Woden mains and output transformers and choke. Full provision and power for Tuner. Output tapped 3, 7.5 and 15 ohms. Competes with the most expensive amplifiers on the market yet costs only **15 gns.** (carriage 5/-). Fitted in portable Steel Cabinet **2 gns. extra.**



"SYMPHONY" AMPLIFIERS with REMOTE CONTROL. Both the above model Amplifiers are available with all controls on a separate Control Panel with up to 4 feet flexible cable which simply plugs into the amplifier. Enables the Amplifier proper to be sat in the bottom of a cabinet whilst the controls are mounted conveniently higher up. Extra cost **2 gns.**

"STUDIO SYMPHONY" AMPLIFIERS, Models 1 and 2, new models specially designed to get the maximum out of the revolutionary new Collaro Studio pick-ups and heads type "P" or Transcription. Specification as per our Standard Symphony models but with high-gain, low-noise, built-in Pre-amplifier stage with separate switched correctors for Std. and L.P. Third position on switch provides input matching for Acos and similar output pick-ups. These remarkable new models thus provide all the facilities and matching of our Standard Symphony Amplifiers PLUS the specialised Collaro matchings. Send for copy of "The Gramophone" review of these instruments. Price: No. 1, **12 gns**; No. 2, **17 gns.** Carriage 5/-.

CURRENT GARRARD PRODUCTS AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK AT PRESENT.

MODEL TA 3-speed unit, but with plug-in turnover head Type G.C.2, **£10/16/-**, or with Acos HGP 33 or 37 heads, **£10/14/-**, or with two separate high fidelity Acos HGP35 heads, **£12/17/-**. Unit less heads, **£8/11/-**, post 2/6. Heads, 42/3 each, post 1/-.

MODEL TB as above, but with long pickup arm. Less heads, **£8/11/-**, post 2/6.
Heads to fit this unit: Decca XMS, **55/-**, Decca Crystal, **35/-**, Garrard Standard Magnetic, **25/-**, miniature magnetic ow impedance, **25/-**, miniature magnetic high impedance, **35/-**. Post on heads 1/-. Unit can be supplied with any combination of above heads and is carefully adjusted for stylus pressure on despatch.

MODEL RC80M, less heads, **£15/5/-**, with new turnover head, **£17/9/6**, with two separate Acos HGP35 heads, **£19/9/-**, carriage 5/-.

COLLARO PICKUPS AND HEADS. Studio Pickup Arm, **13/10.** Studio Pickup head type "O" or "P," **£3/0/9.** Pickup complete **£3/14/7.** Studio Transcription Pickup Arm with Studio "P" head, **£4/15/9.** Ditto with Transcription head, **£5/2/5.**

TRANSCRIPTION MOTORS IN STOCK.

CONNOISSEUR, 3-speed motor, **£23/8/11.**

SNIP NO. 1

GARRARD LATEST MODEL RC80M AUTO-CHANGER. Fitted with full-length Pick-up Arm to take 3-pin plug-in heads, manufactured end of Oct. 1954. PRICE LESS HEADS, **£15/5/-**, plus carriage 5/-. These extraordinarily versatile units can be supplied fitted with the following combinations of Pickup Heads at the following prices:

With two Decca XMS flrr Magnetic Heads, **£20/15/-**.
With two Decca Crystal Heads, **£18/10/-**.
With Decca Crystal for L.P. and Garrard Miniature Mag. for Std. Takes miniature fibre or steel needles. **£18/13/-**.
With adaptor and two Acos HGP39-1 Heads, **£20/5/-**.
With adaptor and one Acos HGP39-1 Head for L.P. and Garrard Miniature Mag High Impedance for Std. Takes miniature fibre or steel needles. **£19/17/-**.

The above combinations of heads are matched for output and stylus pressure carefully adjusted before despatch. Carriage in each case 5/-.
Above mounted in Portable Cabinet **90/-** extra
IMMEDIATE DELIVERY FROM STOCK

SNIP NO. 2

Very latest Model **"MONARCH" 3 speed AUTO-CHANGER** fitted with latest ACOS HGP37 turnover Pickup Head for Std. and L.P. Plays 12in., 10in., and 7in. records mixed in any order. Capacity 10 records. Operates on 100/125 and 200/250 v. A.C. 50 c/s. Unit plate measures 12¼in. x 10¼in. Height above plate required 5¼in.; depth below required 2¼in. PRICE COMPLETE **£13/10/-**. Carriage 5/-.
IMMEDIATE DELIVERY. Leaflet 2½d.
Above mounted in Portable Cabinet, **16 gns.**, plus carriage 7/6.

"SYMPHONY" BASS REFLEX CABINET KITS. 30in. high, consist of fully-cut ⅝in. thick, heavy, inert, non-resonant patent acoustic board, deflector plate, felt, all screws, etc., and full instructions. Bin. speaker model, **85/-**; 10in. speaker model, **97/6**; 12in. speaker model, **£5/7/6.** The design is the final result of extensive research in our own laboratory and is your safeguard of optimum acoustic results. Carriage 7/6. Ready built, **10/6** extra.

HIRE PURCHASE FACILITIES *NOW AVAILABLE on orders of £15 or over.*
Send one-third deposit with order, balance over 6 or 12 monthly instalments. *State which required.*

NORTHERN RADIO SERVICES

11 KINGS COLLEGE RD., ADELAIDE RD. LONDON, N.W.3. *Phone. PRImrose 8314*
Tubes: Swiss Cottage and Chalk Farm.
Buses: 2, 13, 31, 113, 187.

"SYMPHONY" BASS REFLEX CABINETS, fully finished in figured walnut, oak or mahogany to our own design and to match our Console Amplifier Cabinet, enabling the housing of a whole equipment in a two piece suite; cost: 12in. speaker model **£11/10/-**; 10in., **£11**; 8in., **£10/10/-**. Carriage according to area. The 10in. model is ideal for the W8 HF 1012 (see "The Gramophone" review March).

CONSOLE AMPLIFIER CABINETS (above), 33in. high, lift-up lid with piano hinge, take Tape Deck, Gram Unit or Auto-changer, Amplifier Pre-Amplifier, and Radio Feeder Unit, finished medium walnut veneer. De Luxe version, **10 gns.** Carriage according to area. Other veneers 10/- extra.

ANNOUNCING THE
'SECUNDUS'
FOR
SUB MINIATURE WORK
by
ADCOLA
(Regd. Trade Mark)

1/8" BIT
Illustrated ListNo.70
(Actual Size)

SPECIAL FEATURES

1. Traditional British quality.
2. Designed temperatures.
3. Weight 2 oz. (excluding flex)
4. Length 8in.
5. 18 watts.
6. Practical temperature for high class solder jointing.

Supplied in all volt ranges

Models to cover all fields of the Radio, T.V. and Electronic Industry.

For all Soldering Instruments and Allied equipment.

WRITE TO:—

ADCOLA
(Regd. Trade Mark)

Head Office and Sales

GAUDEN RD.
CLAPHAM HIGH ST.
LONDON S.W.4

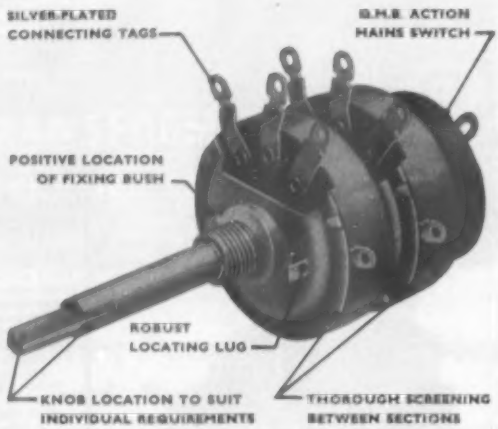
Te ephone
MACAULAY 4272

New

EGEN

DUAL POTENTIOMETERS

● *with concentric operating spindles*


SILVER-PLATED CONNECTING TAGS
D.P.S.E. ACTION MAINS SWITCH
POSITIVE LOCATION OF FIXING BUSH
ROBUST LOCATING LUG
KNOB LOCATION TO SUIT INDIVIDUAL REQUIREMENTS
THOROUGH SCREENING BETWEEN SECTIONS

Designed primarily for television and electronics applications these new Egen Dual Potentiometers incorporate all the outstanding design features — multiple contact rotors, smooth easy movement and freedom from wear and noise — that have made the well-known Egen Type 102 Carbon Potentiometers so dependable in service.

They are thoroughly screened between sections and a convenient soldering tag for earthing screened connections, etc. is provided on each metal case. Switch and potentiometer soldering tags are of high grade brass heavily silver plated for easy soldering; they are positively located and withstand soldering heat and bending without loss of rigidity.

Control spindles can be supplied to suit customers' requirements.

The wide range of EGEN controls includes: Carbon Potentiometers Type 102 · Pre-set Resistors Type 104 · Miniature Carbon Potentiometers Type 105 and 115 · Sub-miniature Volume Controls Type 111, 123 and 125 · T.V. aerial plug and socket · Pre-set potentiometers Type 126/127.

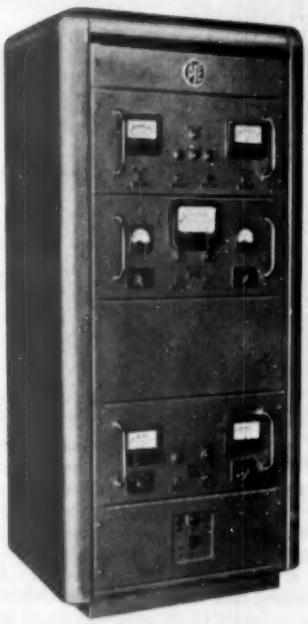
EGEN ELECTRIC LTD., Charfleet Industrial Estate, Canvey Island, Essex • Phone: CANVEY ISLAND 691/2

POINT-TO-POINT FM V.H.F.

RADIO TELEPHONE LINK

There are many V.H.F. links which require one channel only in the first place but where, after a year or two, an expansion of traffic is anticipated. The Pye F.M. link system with a capacity for up to 7-channels is well suited to meet such a need.

The equipment illustrated comprises a complete radio terminal including Receiver, 10 watt Transmitter and an optional 50 watt Amplifier.



Abbreviated Specification

Frequency range 60—216 mc/s

Transmitter output Power 10 watts, or with Amplifier Unit—50 watts

Maximum Deviation 50 kc/s

Overall Transmitter-Receiver Performance

Frequency Response 300 c/s—6 kc/s ± 3 db
6 kc/s—36 kc/s ± 1 db

Intermodulation Level At least -55 dbm for 2 tones applied each at 0 dbm

Receiver Bandwidth 6 db down ± 120 kc/s

Telecommunications

CAMBRIDGE ENGLAND

Pye New Zealand Ltd.
Auckland C.I., New Zealand

Pye Radio & Television (Pty.) Ltd.
Johannesburg
South Africa

Pye Canada Ltd.
Ajax, Canada

Pye Limited
Plaza de Necaxa 7
Mexico 5

Pye-Electronic Pty., Ltd.
Melbourne, Australia

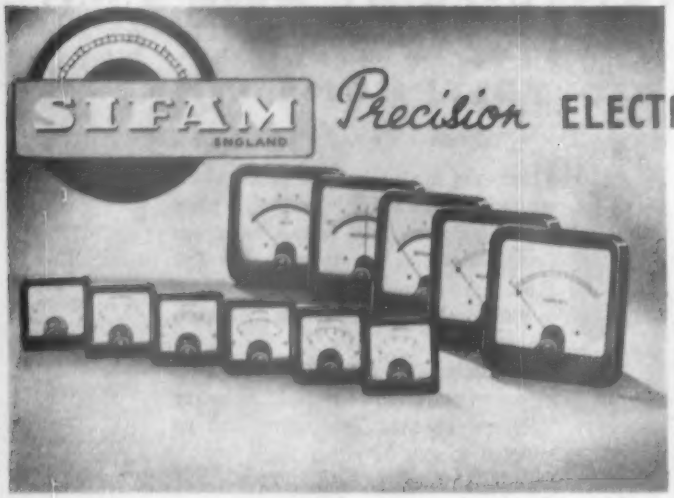
Pye Limited
Tucuman 829
Buenos Aires

Pye Ireland, Ltd.
Dublin, Eire

Pye Limited
5th Avenue Building
200, 5th Avenue, New York

PYE LIMITED . . CAMBRIDGE . . ENGLAND

For the LABORATORY *and* PRODUCTION LINE



Precision ELECTRICAL INSTRUMENTS

In addition to our well-known standard ranges of 2in. to 4½in. square and round panel-mounting instruments, the following are a few examples of special types which we have developed to meet industrial requirements:—

- *Audible Braille Multi-range milli-ammeters.*
- *Contact instruments.*
- *Semi log scaled instruments.*
- *VU indicators and decibel meters.*
- *Modulation meters with special ballistics.*
- *Temperature measuring equipment.*
- *Airborne instruments of special design.*
- *6in. and 8in. portables for precision and industrial use.*

SIFAM Electrical Instruments fully meet the high standards of accuracy and reliability demanded by modern industrial techniques, production control, laboratory testing, etc.

Write for illustrated catalogue detailing the wide SIFAM range.

SIFAM ELECTRICAL INSTRUMENT CO. LTD. Leigh Court, Torquay. *Telephone :* TORQUAY 4547-8

Lend your skill to Britain, doing the job you know best

Army Emergency Reserve

to spend

FIFTEEN DAYS IN CAMP

earning full pay and allowances plus a total of £9 TAX FREE BOUNTY & EFFICIENCY GRANT.

You can spend fifteen days with your friends, earning full Regular Army pay and allowances. As a member of the Army Emergency Reserve (Cat. IIA) you have no other duties during the year. If a grave national emergency should arise, you may be called up for service in the United Kingdom. You can be called out for overseas service only by Proclamation.

Volunteers are accepted from 18 years of age and engagement is for two, three, or four years. If you have served before in a non-commissioned rank there is every possibility of your filling an existing vacancy or of being promoted as soon as a vacancy occurs.

Send this coupon now for details of how to join to O.C. H.Q., A.E.R., R. Signs., Blacon Camp, Chester.

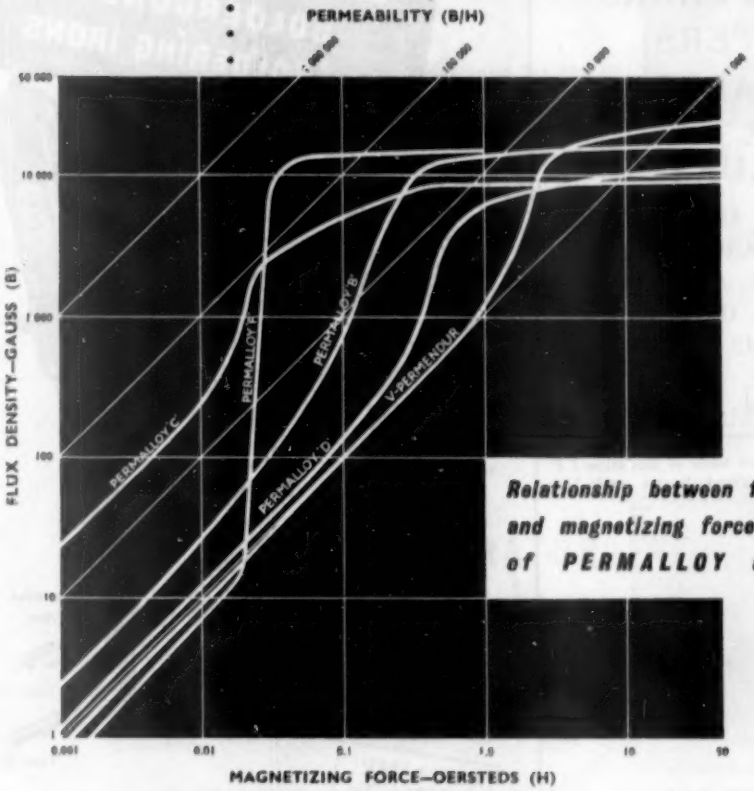
NAME _____

ADDRESS _____

W.D. 510

Standard

magnetic alloys *for* component designs *of* maximum efficiency



Relationship between flux density, permeability and magnetizing force for the various grades of PERMALLOY and V-PERMENDUR.

HIGH quality and consistency, backed by first-class service, are important features in this range of *Standard* magnetic alloys. As large-scale users of Permalloys in communication, electronics and other fields, *Standard* enjoy the unique advantage of observing these alloys under normal working conditions, a factor which has played an important part in their development.

Please ask for further particulars.

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, W.C.2

TELEPHONE LINE DIVISION: North Woolwich, London, E.16

"WEYRAD"

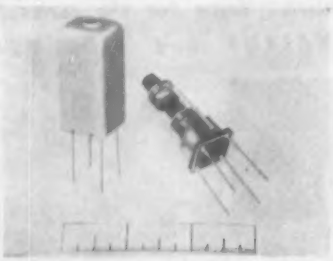
RADIO COMPONENTS FOR THE DISCERNING USER

MANUFACTURERS
EXPORTERS
WHOLESALERS
AND
AMATEURS

IF YOU NEED R.F. OR I.F. COILS, COIL UNITS AND TRANSFORMERS OR L.F. TRANSFORMERS AND CHOKES, OUR WIDE RANGE OF PRODUCTS COVERS MANY ITEMS WHICH WILL INTEREST

YOU

We have recently developed a new series of miniature I.F. Transformers. Compact mechanical layout and high performance are achieved at very low cost.



TYPES P.6/1 AND P.6/2

Litz-wound on moulded bakelite formers. Dust core trimmed.

Operating frequency 460-480 Kc/s.

P.6/1 "Q" (IN CAN AT 470 Kc/s) = 85.
BANDWIDTH = 9 Kc/s AT −6db.

P.6/2 "Q" (IN CAN AT 470 Kc/s) = 125.
BANDWIDTH = 8.5 Kc/s AT −6db.

We are also A.I.D. and A.R.B. approved and can quote for the production of all types of components to M.O.S. specifications.

WEYMOUTH RADIO MFG. CO., LTD.,
CRESCENT ST., WEYMOUTH, DORSET.

4 reasons why...

IT PAYS TO SOLDER with

Wolf Electric SOLDERGUNS and SOLDERING IRONS

- RAPID CONSTANT HEAT
- ABSOLUTE DEPENDABILITY
- SOLID CONSTRUCTION
- PERFECT BALANCE

TRIGGER FEED SOLDERGUN

Type No. 51 is designed specially for all assembly operations. Solder is fed automatically with trigger-action and two reels are supplied—one 15 ft. acid-cored and one 15 ft. resin-cored.

Unbeatable from every point of view, well able to withstand hard workshop treatment and ideal for continuous use. Features include rapid constant localised heat—solid sturdy construction—low current consumption—perfect balance—absolute dependability. A type and bit for every purpose from fine instrument to heavy industrial work.

Each tool includes 5 feet tough rubber 3-core cable.

Obtainable from all leading tool merchants and factors.
Fully descriptive Brochure free on request.

WOLF ELECTRIC TOOLS LTD · PIONEER WORKS · RANGER LANE · LONDON · W.3

Taylor

NEW!! JUST RELEASED!!

T.V. SWEEP OSCILLATOR

Model 92A

Covering Band III

Frequency modulated oscillator designed for the rapid and accurate alignment of T.V. receivers. Also suitable for checking in band pass amplifier.

Frequency range:	5-250 mc/s.
Frequency deviation:	Continuously variable to approx. 15 mc/s.
Output:	40 microvolts to 2 millivolts continuously variable.
Amp. Mod.:	Substantially linear to 6 mc/s sweep width—less than 10% max. sweep.
Sweep:	Sweep voltage continuously variable to a max. of 300-v R.M.S.
Power Supply:	110/250 v. 4/100 c/s, 40 watts approx.
Valves:	ECC91—2 off, 6Z4—1 off, 12AT7—1 off, Z309—1 off.
Weight:	15lb. approx. (6.8 kg).
Dimensions:	5in. x 13in. x 9in. (12.7 x 38 x 23 cms).

Cash Price £30 . 0 . 0 *PROMPT DELIVERY*

Write for Illustrated Catalogue and Separate Leaflet

NEW

T.V. SIGNAL GENERATOR

Model 67A

This reliable Signal Generator is intended for T.V. and Radio Service work. The Colpitt's oscillator circuit used on all ranges gives good frequency stability and waveform.

Frequency range:	100 Kc/s—240 Mc/s.
Accuracy:	±1%.
Attenuation:	Continuously variable 100 dB.

Cash Price £22 . 0 . 0 *PROMPT DELIVERY*

Write for Illustrated Catalogue and Separate Leaflet

All Taylor Instruments are available on 3 months "No Interest" H.P. terms. Alternative advantageous terms for 10 and 15 months.

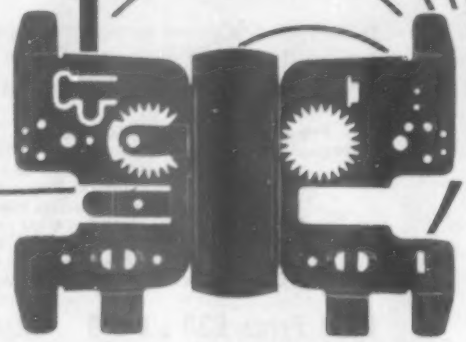
TAYLOR ELECTRICAL INSTRUMENTS LTD., MONTROSE AVENUE, SLOUGH, ENGLAND

Telephone: SLOUGH 21381/3 Telegrams: TAYLINS, SLOUGH.

Delanco
REGD.

— the link between good reception and good service . . .

In the Radio Industry, perfect reception can only be obtained by using good sets—and GOOD SETS ARE MANUFACTURED FROM THE BEST COMPONENTS.
"DELANCO" materials maintain a high standard of quality and are able to stand up to the strain of continual use. Start using our high-class components to-day and you will be among our valued customers who are regular users of "DELANCO" INSULATING MATERIALS.



Photograph of stamping by courtesy of Murphy Radio Ltd. . . .

ANGLO-AMERICAN VULCANIZED FIBRE CO. LTD.
CAYTON WORKS, BATH STREET, LONDON, E.C.1. Phone CLE 3271

INTRODUCING THE NEW

RD JUNIOR

AMPLIFIER AND CONTROL UNIT

Designed solely as the nucleus for domestic high fidelity installations, the new RD JUNIOR will, we believe, become recognised as the finest amplifier of its type so far produced in this country.

MAIN FEATURES

★ Power Output 8-10 watts ("UL" Class "A" p.p. EL84s) ★ Distortion .12% at 8 watts ★ Frequency Response ± .25 DB 20-30,000 cps ★ 20 DB NFB ★ Hum and Noise—80DB below 8 watts ★ O.P.T. employs C-core lamination material ★ Simplified speaker matching ★ Ample Spare Power (40m/A H.T.) ★ Four accurate playback characteristics ★ Two Radio Inputs ★ Simplified pick-up matching ★ High Input Sensitivity ★ INDEPENDENT VARIABLE LOW PASS FILTER ★ Switched Bass and Variable Treble Controls ★ Tape Record and Replay Jacks ★ Choice of Panel Colours—BLACK, IVORY, BRONZE, or RED ★ TWO-YEAR GUARANTEE:

PRICE COMPLETE **£25**

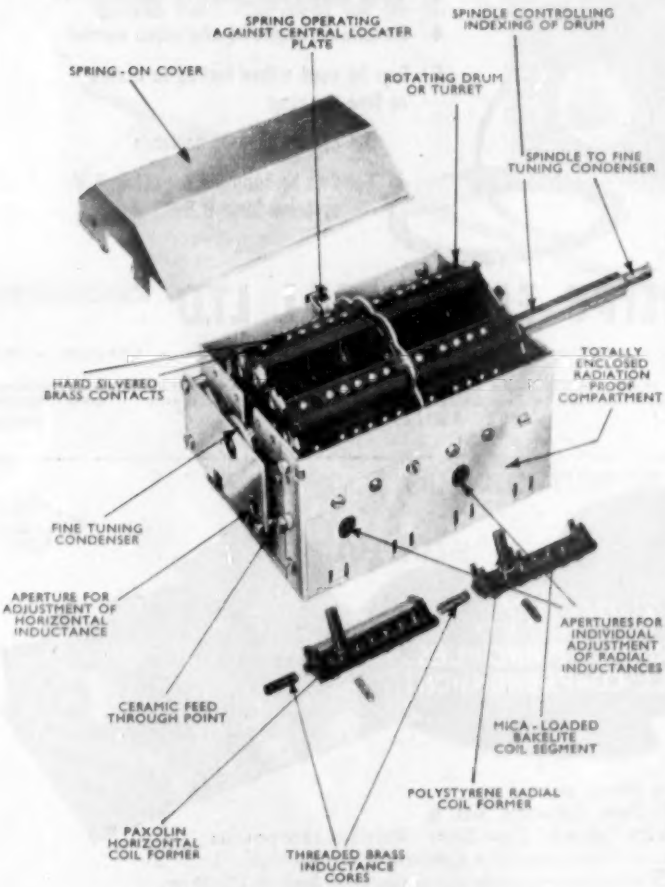
12-page Illustrated Booklet post free on request.

Trade and Export enquiries invited.

ROGERS DEVELOPMENTS CO.

"RODEVCO HOUSE," 116, Blackheath Road, Greenwich, London, S.E.10. TIDeway 1723

Six Advantages of the Clix TELEVISION TURRET TUNER


SPRING OPERATING AGAINST CENTRAL LOCATER PLATE
SPINDLE CONTROLLING INDEXING OF DRUM
SPRING-ON COVER
ROTATING DRUM OR TURRET
SPINDLE TO FINE TUNING CONDENSER
TOTALLY ENCLOSED RADIATION PROOF COMPARTMENT
HARD SILVERED BRASS CONTACTS
FINE TUNING CONDENSER
APERTURE FOR ADJUSTMENT OF HORIZONTAL INDUCTANCE
APERTURES FOR INDIVIDUAL ADJUSTMENT OF RADIAL INDUCTANCES
CERAMIC FEED THROUGH POINT
MICA-LOADED BAKELITE COIL SEGMENT
POLYSTYRENE RADIAL COIL FORMER
PAXOLIN HORIZONTAL COIL FORMER
THREADED BRASS INDUCTANCE CORES

Full technical information and prices on request.

Available to set manufacturers only

EDISWAN CLIX

THE EDISON SWAN ELECTRIC CO. LTD.

Member of the A.E.I. Group of Companies

1 *Accurate switching.*

The rotating drum of the Ediswan Clix Television Turret Tuner indexes accurately to any of twelve positions and re-sets precisely in these positions after switching. No question of mistuning after switching.

2 *All circuits are adjustable with the unit in position in a Television receiver.*

Adjustable cores to all inductances are easily accessible with the tuner in position in a Television receiver.

The tuner can, therefore, be set up or re-adjusted in its actual operating position.

3 *Additional tuned circuits may be added at any time without removing the Tuner from the receiver.*

The Ediswan Clix tuner is designed so that additional coil segments can be added at any time while the tuner is in position in a receiver.

To tune to another channel the serviceman merely clips into position additional coil segments, carrying correctly wound coils, and trims them by the adjustable cores provided.

There is no need to dismantle the tuner or return it to the Factory for any part of this operation.

4 *Wiring reduced to an absolute minimum thereby eliminating stray capacities.*

Stray capacities between wiring can lead to serious mistuning on the very high frequencies of Television Band 3. The Ediswan Clix Tuner is designed so that wiring is reduced to an absolute minimum and materials are specially selected to overcome the problems of drift and instability encountered on these frequencies.

5 *Easily accessible for servicing.*

The 'L' section and 'U' section which form the Ediswan Clix tuner are easily parted without removing the drum. This gives easy access to the wiring on the 'L' plate for servicing purposes.

6 *Suitable for mounting in deep or shallow chassis.*

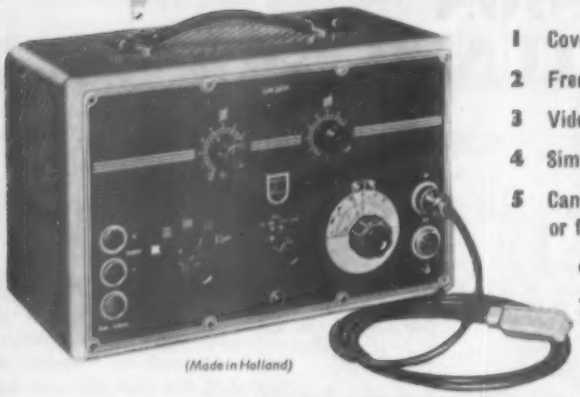
Four 4BA tapped holes are provided for mounting the Ediswan Clix Turret Tuner. If required, suitable mounting brackets can be provided for use in shallow chassis.

CR8

155 Charing Cross Road, London, W.C.2. Radio Components Sales Office: 21 Bruton St., London, W.1. *Tel: Mayfair 5543*

FOR T.V. SERVICE ON BAND III

T.V. SERVICE PATTERN GENERATOR TYPE GM 2891



(Made in Holland)

1. Covers both Band I and Band III
2. Frequency and Channel indication on dial
3. Video signal both positive and negative
4. Simultaneous sound and video carrier
5. Can be used either locked to mains or free running
6. Choice of four patterns
7. Can be supplied for other T.V. systems than B.B.C.

PHILIPS ELECTRICAL LTD

INDUSTRIAL DIVISION • CENTURY HOUSE • SHAFTESBURY AVENUE • LONDON • W.C.2

ARC AND RESISTANCE WELDING PLANT AND ELECTRODES · HIGH FREQUENCY GENERATORS · ELECTRONIC MEASURING INSTRUMENTS MAGNETIC FILTERS · BATTERY CHARGERS & RECTIFIERS · LAMPS & LIGHTING EQUIPMENT · X-RAY EQUIPMENT

(PM10068)

Achievement

IN RECORDING PRINCIPLES BEYOND ALL COMPREHENSION

The AC60 recording amplifier is exactly as used in the new "Impresario" Tape Recorders and is designed primarily for use with the "Elpico" Tape Deck. Together, they provide the finest tape recorder of the age as well as concurrent or independent use as a high fidelity amplification system with a frequency response substantially flat from 48-15,000 cps.

THE "ELPICO" TAPE DECK
Twin track to British and U.S.A. standard. Two-speed, 7½in. and 4½in. p/s. Record/Playback and Erase heads. A.C. only. 19 Gns.

THE AC60 RECORDING AMPLIFIER
5 valves, 4 watts output. All connections for external instruments as well as tape deck recording, bias and erase voltages. A.C. only. 19 Gns.

Ask your dealer or write direct to us for fullest information:—

LEE PRODUCTS

(GREAT BRITAIN) LTD.

"Elpico House," Great Eastern Street, London, E.C.2

Telephone: BIShopsgate 0444-5-6

the short answer

Neither we
nor our licensees
infringe
any competitor's
patents.

PHOTO PRINTED CIRCUITS LTD.

GUILDFORD ROAD · BISLEY · SURREY

Telephone: BROOKWOOD 2200

Industry is Solving Valve Testing Problems

WITH THE **Mullard** HIGH SPEED VALVE TESTER

Industries which deal extensively with radio and other electronic equipment are finding the Mullard High Speed Electronic Valve Tester ideal for routine checks. This instrument provides the quickest method of checking large quantities of valves, and can be operated if necessary by non-technical personnel after only a few minutes' instruction.

Write for full details and a copy of the folder "High Speed Testing in Industry" to Department E.V.D. at the address below.

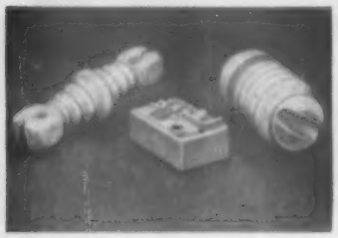
Mullard

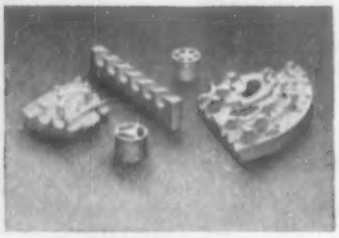
MULLARD LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, W.C.2

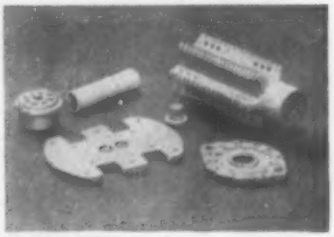
MVM266A

Bullers CERAMICS
FOR INDUSTRY

High quality material and dimensional precision are attributes of Bullers die-pressed products.
Prompt delivery at competitive prices.







We specialise in the manufacture of—

PORCELAIN
for general insulation

REFRACTORIES
for high-temperature insulation

FREQUELEX
for high-frequency insulation

PERMALEX & TEMPLEX
for capacitors

BU12C

BULLERS LIMITED
MILTON · STOKE-ON-TRENT · STAFFS
Phone: Stoke-on-Trent 21381 (5 lines) · Telegrams & Cables: Bullers, Stoke-on-Trent
Ironworks: TIPTON, STAFFS Phone: Tipton 1691
London Office: 6 LAURENCE POUNTNEY HILL, E.C.4 Phone: MANsion House 9971

Immaculate...

BRITAIN'S MOST POPULAR

15 WATT

HIGH FIDELITY

LOUDSPEAKER

Axiom 150 MARK II

PRICE **£10.5.6** (TAX FREE)

BRIEF SPECIFICATION

Frequency coverage ...	30–15,000 c.p.s.
Fundamental resonance	35 c.p.s.
Flux density	14,000 gauss.
Nett weight	12 lb. 15 oz.

POST THE COUPON BELOW for full details of the Axiom 150 Mark II and our other High Fidelity loudspeakers including crossover systems, bass reflex chambers etc

Goodmans

GOODMANS INDUSTRIES LTD

AXIOM WORKS, WEMBLEY, MIDDX. WEMbley 1200

To: GOODMANS INDUSTRIES LTD.
Axiom Works, Wembley, Middlesex.

I am interested in:

Name .....

Address .....

.....

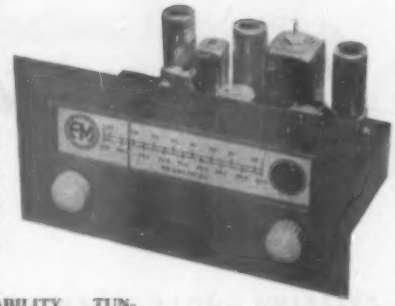
WW.2/55 *Please write in block capitals*

C

To meet a need . . .

Since the Copenhagen Wavelength Convention in 1948 there has been rapid deterioration in the reception on both medium and long wave stations, until we arrive at a position where nearly 800 stations are transmitting on space that can only accommodate 250.

In July of last year the P.M.G. announced the B.B.C.'s scheme for a series of F.M. stations to overcome the present chaotic conditions. The B.B.C. are now transmitting F.M. programmes from Wrotham in Kent of unsurpassable quality with uncanny freedom from background noise. The F.M. service will shortly be extended to many parts of the country. The listener must now do his share by using equipment capable of doing justice to these high quality transmissions.



Armstrong

Specialists in High Quality Reproduction for over 20 years

announce the FM56 Tuner

- **PERMEABILITY TUNING** combined with special temperature compensated capacitors in the oscillator circuit ensuring FREEDOM FROM DRIFT.
- **MAGIC EYE** tuning indicator to facilitate accurate tuning.
- **AUTOMATIC LIMITING** is achieved by the use of a balanced ratio detector discriminator, and an I.F. limiting stage.
- **VALVES.** The latest type MULLARD — ECC85, EF85, EABC80, EM34.

PLUS

- An A.F. attenuator enabling the unit to be used with a high gain amplifier* or a domestic radio receiver such as the ARMSTRONG PC.48.
- A 3 position input socket enables the unit to be used with any amplifier having auxiliary power supplies of from 250 to 400 volts.

Circuit: A low noise triode R.F. stage is coupled to a high stability frequency changer. This is followed by two I.F. stages and a triple diode triode ratio detector and A.F. stage. **Coverage:** 85 to 95 mc/s. **Output:** 3 volts r.m.s. max. **Image Rejection:** 26 db. **I.F. Rejection:** 60 db. **Power supplies required:** 30 mA. at 250 volts 6.3 v. 2 amps. **Size:** Panel 9½ × 5½ cut-out required: 9in. × 4¼in.

Price: £21.0.0 (inc. tax).

*See page 75 for details of the Armstrong A.10 High Fidelity Amplifier.

Visit our Showrooms (address below). Weekdays 9—6 p.m. (Sats. until 5 p.m.). High Fidelity Demonstration on Thurs. at 7 p.m. For further details write to Dept. W.F.

ARMSTRONG *WIRELESS & TELEVISION CO. LTD., WARLTERS ROAD, LONDON, N.7.* *Telephone: NORth 3213.*

Handles with
many times the life of wood
and blades of Sheffield steel,
chromium-plated to prevent rust,
combine to make Screwmasters that
will last a lifetime. Fully insulated to 5,000 volts

PLASTIC & AMBER HANDLED

Screwmasters

Obtainable from Suppliers everywhere

STEAD

Manufactured by J. STEAD & Co. Ltd., SHEFFIELD 2

LESS THAN 1% DISTORTION

TAPE RECORDISTS! Are you **COMPLETELY** satisfied with your recordings? Bad waveform in an oscillator can cause DISTORTION due to intermodulation, NOISY BACKGROUND due to D.C. component in an asymmetrical waveform and INTERFERENCE with radio due to harmonics beating with incoming signal. The fundamental cannot do this!

The Ordinary Hartley circuit suffers from the disadvantage—that good waveform, large output, and stability do not go together. The new HATFIELD oscillator is GUARANTEED to give at least 4 watts output with less than 1% distortion, and high stability, using only one valve (6V6 or similar). 45 Kc/s to 50 Kc/s. Suitable for high impedance heads, Motak, Lane, Truvox, etc.

COIL, complete with circuit, **10/6** post free. Patent app. for.

BIAS REJECTOR COILS

Even a small amount of bias frequency getting into the amplifier can cause a lot of trouble, and nearly all tape recorders need a rejector coil to prevent this.

COIL, complete with instructions, **5/6** post paid.

MOTEK TAPE DECKS

The famous K6 deck; twin track, two speed, with push buttons and electronic braking, is a beautifully finished job at only **£19/19/-**. Post free. Or £3 down and 12 monthly payments of **£1/10/-**

TAPE AMPLIFIERS

The HATFIELD amplifier is complete with oscillator as above, and magic eye, less speaker, at **£12/15/-**.

COMPLETE RECORDERS

The **HERGA** recorder incorporates ALL the above items together with a first-class crystal mike and one reel of SCOTCH BOY tape in an attractive two-tone portable cabinet, absolutely complete at **39 gns.** Or £5 down and 12 monthly payments of **£3/3/4.**

Further details and H.P. terms from:

HATFIELD RADIO

78 STROUD GREEN RD., LONDON, N.4

FLEXIBLE REMOTE CONTROL OUTFITS

Our experience in the industrial field has indicated that there is a definite need for this type of outfit offering facilities for making prototype flexible remote controls as required.

The three gauges of Remote Control flexible shafts in these outfits cover the range of torque loadings required for • volume controls • all types of wave change switches • condensers • all controls likely to be met in electronic, radio and television equipment.

These outfits are reasonably priced and comprise:

No. 117 (.117 in. dia.) for remote controls up to 3 in. in length.....**£6.10.0**
No. 130 (.130 in. dia.) for remote controls up to 7 in. in length.....**£7. 0.0**
No. 150 (.150 in. dia.) for remote controls of a heavier type up to 12 in. in length.....**£7.10.0**

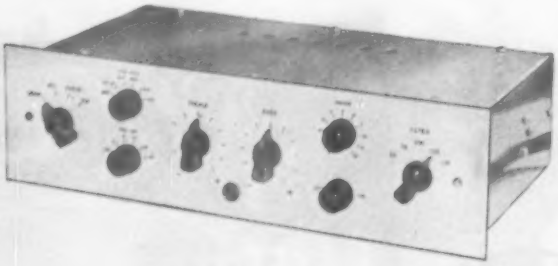
The S. S. White Company will be pleased to advise which Outfit is most suitable for specific applications.

A detailed Parts List is available upon request.

THE S·S·White CO OF GREAT BRITAIN LTD
INDUSTRIAL DIVISION

BRITANNIA WORKS, 25-31 ST. PANCRAS WAY, LONDON, N.W.1. Telephone: EUSton 5393

GOODSELL



Williamson Amplifiers (below)

Type illustrated is the GW12 fitted with large 'C' core output transformer.

Price GW18 **£33 : 15 : 0**
with 'C' core **£38 : 5 : 0.**

GW12 **£27 : 10 : 0**
with 'C' core **£32 : 0 : 0.**

Type PFA Pre-amplifiers (above)

The latest PFA unit is built especially for use with our range of Williamson Amplifiers. Separate bass and treble control in equaliser section. Low noise—high gain. 5 mv. input. 6 valves. Price **£20.**

★ *Demonstrations of all these units at B.K. Partners Ltd., 229 Regent St., London, W.1, and Classic Electric Co. Ltd., Croydon.*

GOODSELL LTD.

40 Gardner Street · Brighton 1 · Sussex

Tel. : Brighton 26735

BK *have pleasure in introducing the*

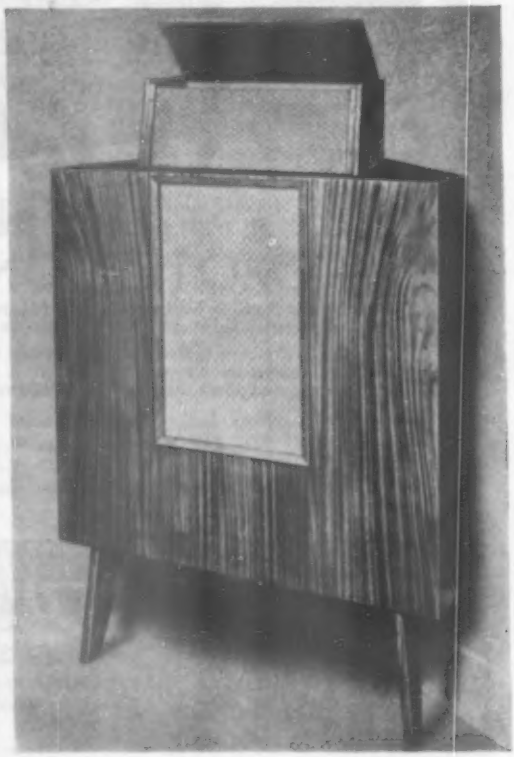
H.C.12

Corner Horn Assembly

Designed and executed for those who appreciate near perfection in Sound Reproduction.

★ H.P. TERMS AVAILABLE

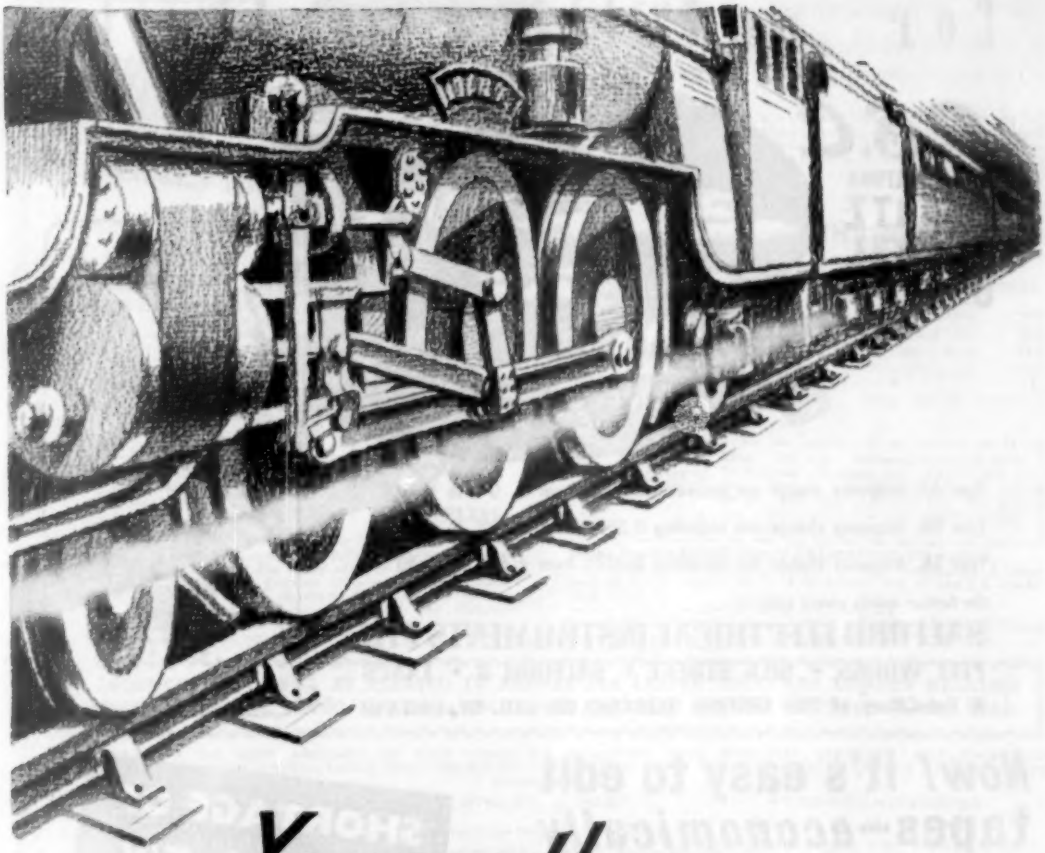
This and other fine loudspeaker systems are demonstrated daily at our Regent Street Showrooms on audio amplifiers by LEAK, GOODSELL, ACOUSTICAL, ROGERS and ARMSTRONG.



Send for illustrated brochure.

B. K. PARTNERS LTD.

229 Regent St., London, W.1. (Entrance Hanover St.) 'Phone: REG 7361



You are there...

The crescendo of an approaching train is one of those complex sounds which are such a test of fidelity in a reproducing system.

How far a Set Designer can go along the line to fidelity is often a question of cost. Presence for price, we believe he should go just as far as Wolverhampton.

We would not mention this if it were only our own opinion, but we are proud to say it is also that of many very good engineers who have no axe to grind.

Incidentally, the sound of axe grinding is rather a pretty test of fidelity!

B&A

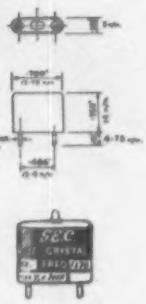
LOUD-SPEAKER MANUFACTURERS TO THE RADIO INDUSTRY SINCE 1930

REPRODUCERS AND AMPLIFIERS LIMITED . WOLVERHAMPTON . ENGLAND

for unfailing activity

G.E.C.
SUB-MINIATURE
QUARTZ CRYSTAL UNITS

Q.C. 500
Frequency range
10,000 Kc/s to 16,000 Kc/s.



Type BA, frequency change not exceeding 0.01% from 0°C to + 70°C
Type DA, frequency change not exceeding 0.01% from −30°C to + 45°C
Type EA, frequency change not exceeding 0.002% from + 65°C to + 80°C

For further details please apply to:-

SALFORD ELECTRICAL INSTRUMENTS LTD
PEEL WORKS • SILK STREET • SALFORD 3 • LANCS
A Subsidiary of THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

Now! it's easy to edit tapes—*economically*

USE A PROFESSIONAL TYPE RECORDING TAPE SPLICER FOR EDITING AND MENDING RECORDING TAPE

- The Bib Recording Tape Splicer enables you to edit tapes easily in the same way that cine film enthusiasts edit films.
- Tapes can be joined precisely and quickly and, because you can use up all odd lengths of tape, you soon save the cost of the Splicer.
- Sturdily made of nickel-plated brass, the Bib Splicer is mounted on a flock-covered panel. The razor cutter fits neatly under the Splicer. If desired the Splicer can be attached directly to a tape recorder deck. The Bib Splicer is made to an accuracy of plus or minus one thousandth of an inch. It is equally efficient for joining broken recorded tapes without any recorded signals being missed.
- Bib Recording Tape Splicer (Prov. Pat. 25520) enables tapes to be accurately positioned, cut and surplus cellulose tape trimmed. Joins are not discernible when these tapes are re-used.

18/6 each (subject)

Bib **RECORDING TAPE SPLICER**
Get one from your local stockist today. In case of difficulty write to us giving his name and address. Send stamped addressed envelope for full details.

MULTICORE SOLDERS LTD.
Dept. WW2, MULTICORE WORKS, HEMEL HEMPSTEAD, HERTS (BOXMOOR 3636)

SHORTAGE OF RADIO & T/V ENGINEERS

The demand of Industry for our trained students is still greater than we can supply—and is likely to remain so for many years.

We offer
FULL TIME DAY COURSE
1-year course in Principles and Practice of Radio and Television.

Next course commences April 19th, 1955.

Write for FREE BROCHURES giving details of the above, of our 3-year course (commencing 29th August) and of others.

E.M.I. INSTITUTES—*the only college which is part of a great industry.*

E.M.I. INSTITUTES
(Dept. 127A)
10, PEMBRIDGE SQUARE, LONDON, W.2.
Tel. : BAYswater 5131/2.

Associated with
'H.M.V.'
MARCONIPHONE
COLUMBIA
etc.

IA 21

OSMOR

radio products ltd.

(Dept. W.62) 418 BRIGHTON RD, SOUTH CROYDON, SURREY. *Telephone Croydon 5148/9*

These really powerful units in compact form give quality and performance right out of proportion to their midget size and modest cost. Osmor "Q" Coilpacks have everything that only the highest degree of technical skill can ensure—**extra selectivity, super sensitivity, adaptability.** Size only 1¾ x 3½ x 2½ with variable iron-dust cores and Polystyrene formers. Built-in trimmers. Tropicalised. **Prealigned.** Receiver-tested and guaranteed. Only 5 connections to make. All types for Mains and Battery superhets, and T.R.F. receivers. Ideal for the reliable construction of new sets, also for conversion of the 21 Receiver, TR.1196, Type 18, Wartime Utility and others. Send to-day for particulars!

SEPARATE COILS 4/-

A full range is available for all popular wavebands and purposes. Fully descriptive leaflets and connection data available. (Optional) new simple fixing 2d. extra. Just note these "5 Star" Features. * Only 1in. high. * Packed in damp-proof containers. * Variable iron-dust cores. * Fitted tags for easy connection. * Low loss Polystyrene formers. L. or M.W. T.R.F. REACTION COIL TYPE QR 11-12, 4/9.

A range of coils for F.M. Receivers shortly available.

A special design of coils now available for reflex circuits.

OSMOR STATION SEPARATOR

The Separator may easily be tuned to eliminate any one station within the ranges stated and fitting takes only a few seconds. Sharp tuning is effected by adjusting the brass screw provided.

7'6 COMPLETE

TYPE	METRES
1	141-253
2	218-283
3	267-341
4	319-405
5	395-492
6	455-567
7	1450-1550
8	410-550 k/c.

CHASSIS CUTTER

Type	Hole Sizes	Prices
1	⅞in. x 1⅛in.	19/6
2	⅞in. x 1⅛in.	18/9
3	⅞in. x 1⅛in.	22/6
4	1⅛in. x 2in.	27/3

Illust. list on request.

I.F.s. 465 k.c. Permeability-tuned with flying leads. Standard size 1⅛in. x 1⅛in. x 3½in. For use with OSMOR coilpacks and others, 14/6 pair. Midget I.F.s 465 k/c. ⅞in. x ⅞in. x 2½in., 21/- pair. PREALIGNED. 1/6 extra, both types.

FREE! Send 5d. (stamps) for fully descriptive literature including "**The really efficient 5-valve Superhet Circuit and Practical Drawings,**" 6-valve ditto, 3-valve (plus rectifier) T.R.F. circuit, Battery portable superhet circuit, Coil and Coilpack leaflets, Chassis Cutter leaflet, and full radio and component lists, and interesting miniature circuits, etc.

DIALS—VARIOUS DIALS CALIBRATED TO COILS
Metal dials, overall size 5¼in. square. Cream background, 3-colour Type MI, L.M.S. waves. M2, L. & M. waves. M3, M. and 2 S. waves. Price 3/6 each.
Pointer 1/6; Drum, Drive, Spring and Cord, 3/3.
Type A glass dial assembly, measuring 7in. x 7in. (9½ x 9½ overall). Mounts in any position. Choice of two 3-colour scales, 24/6. P. & P. 1/6.

OUR TECHNICAL DEPT. WILL BE PLEASED TO ANSWER (BY LETTER ONLY) ANY ENQUIRY RELATING TO CIRCUITS IN WHICH OSMOR COILS OR COIL PACKS ARE USED OR ARE INTENDED TO BE USED.

WE ENDEAVOUR TO KEEP ABREAST OF THE TIMES BY BUILDING THE VARIOUS CIRCUITS PUBLISHED IN "WIRELESS WORLD," "PRACTICAL WIRELESS," "RADIO CONSTRUCTOR" ETC. WE KEEP STOCKS OF THE COMPONENTS SPECIFIED.

"PRACTICAL WIRELESS"
Coronet Four; Beginners' Superhet; Modern High Power Amplifier 2; Attache Case Portable; R1155 Converter; A.C. Band-Pass 3; Modern 1-Valver; 3-speed Autogram, modern reflex, etc.

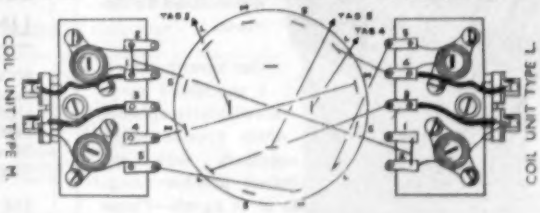
"WIRELESS WORLD"
"No Compromise" TRF Tuner. "Midget Mains Receiver." Sensitive 2-valve Receiver. Television Converter (special coils in cans available). Midget sensitive T.R.F., etc.

"RADIO CONSTRUCTOR"
Converting the TR1196 receiver to a general purpose s'het receiver simple crystal diode set. Radio feeder units. Economy 8 W.P.P. Amplifier. Circuit and details available for adding push-pull to the 5/6 valve Osmor superhet.

A LIST OF FIXED CAPACITIES AS REQUIRED FOR SWITCH TUNING AVAILABLE ON APPLICATION

'Q' COIL UNITS MAKE EASY SWITCHING

Wavebands may be added or changed in a few minutes. Switching arrangements can be increased as required. Multi waveband Coilpacks may be easily made up. The Coil Unit consists of Aerial and Oscillator Coils and Trimmers wired and ready to connect to switch.



THE SIMPLEST AND MOST COMPLETE METHOD OF SET BUILDING SO FAR DEVISED FOR THE AMATEUR.

15'- PER UNIT including 4 foolproof drawings.

NEWCOMERS TO RADIO: WE HAVE A NEW DEPARTMENT READY AND WILLING TO HELP

DESIGNERS ARE ASSURED OF FULL CO-OPERATION

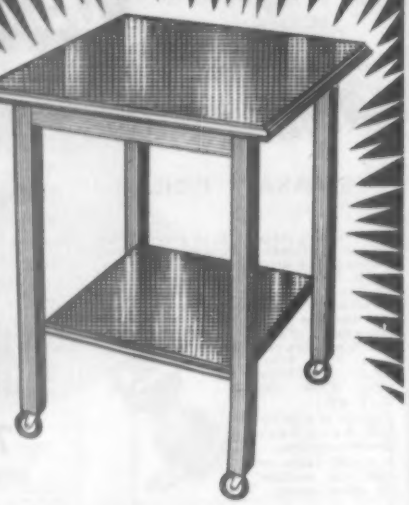
Please let us know your requirements — send us your problems.

IT'S NEW! IT'S SUPERB! IT SELLS!

TELEVISION TROLLEYS

RETAIL PRICE :-
£3-19-6
FULL RETAIL AND WHOLESALE MARGINS

ASSEMBLED IN A FLASH!



Strong, stable, secure construction.
Available in beautiful Walnut Veneer
or with Solid Oak top and shelf.

Top, 20 inches square.
Height, 26 inches.

REXON INDUSTRIES Ltd.

Sole Selling Agents: FIRVIEW SALES LTD.
THANET HALL, THANET STREET, LONDON, W.C.1 Tel. EUSton 6891/2/3.

then and now

S. G. Brown

HEADPHONES FOR MARINE EQUIPMENT

Every seagoing vessel in this electronic age relies on Marine Communication Equipment.

Our contribution is a specialised range of reliable Headphones which provide ships' operators with the clearest possible reception of all signals—Morse or speech.

S. G. Brown provide Headphones and associated equipment for all known purposes.

Brochure "W" sent on request.

S. G. Brown, Ltd.

SHAKESPEARE STREET, WATFORD, HERTS.
Telephone: Watford 7241.

(1)

SOLDERING with a PRIMAX

70/-
Post free

with the sensational new UNBREAKABLE CASE

NEW MODEL can now be used ALMOST CONTINUOUSLY without overheating. Weighs only 24 oz. Loop for hanging now provided.

The ideal tool for any RADIO - TV - TELEPHONE mechanic or amateur.

Available in 110, 200/220, 220/250 v. for A.C. only. 50/60 Cycles (60 w.).

BALANCED GRIP SOLDERING GUN

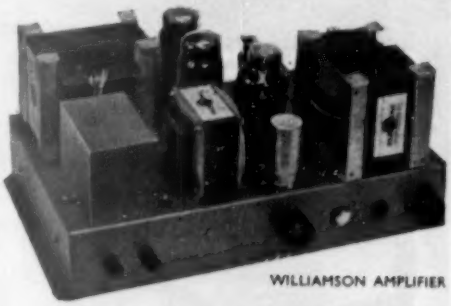
Specially designed for soldering on hard-to-reach jobs.

★ **INSTANT HEATING**—Ready for soldering in 6 seconds.

★ **EXCLUSIVE ALLOY TIP**—lasts indefinitely under normal use and care.

★ **One year's guarantee.**

Sole Distributors :— **S. KEMPNER LTD.**
29 Paddington St. (off Baker St.), London, W.1.



WILLIAMSON AMPLIFIER

P.A.1 PRE-AMP

AMPLIFIERS

OSRAM 912

This renowned amplifier complete—with drilled chassis—front panel. Brand new B.V.A. Valves. All transformers approved by G.E.C. Everything included.
Partridge Kit £22/6/3. Wired and Tested £4 extra.
Haddon Kit £21/19/3. Tele-Radio Kit £18/18/6.

WILLIAMSON

This amplifier justly celebrated all over the world. Absolutely complete with all parts.
Partridge Kit £22/1/-. Wired and Tested £26/15/6.

P.A.1 PRE-AMP FOR WILLIAMSON AMPLIFIER

The P.A.1 pre-amp. especially designed by us—for use with the Williamson. Up to a standard—Down to a special price.
Kit £6/16/6. Wired and Tested £8/18/6.

MULLARD 5-10

This clever new amplifier is offered complete to last nut and bolt. Brand new B.V.A. Valves. First quality components throughout.
Kit Price £12/10/-.

LEAK

TL.10 £17/17/-. Point 1 Pre Amp. £10/10/-.
Vari-Slope Mk. II £16/16/-. TL.12 £28/7/-. TL.25 £34/7/-.

QUAD

Quad II £22/10/-. Quad II Control Unit £19/10/-.

SPEAKERS

G.E.C. Metal Cone		£8	15 0
WHARFEDALE	Super 5 CS/AL	£6	13 3
"	Bronze 8 AL	£3	10 8
"	Super 8	£5	13 3
"	Super 8 CS	£6	6 7
"	Super 8 CS/AL	£6	13 3
"	Golden 10	£7	13 3
"	Golden CSB	£8	6 7
"	W.12	£9	5 0
"	W.12 CS	£9	15 0
"	Super 12 CS/AL	£17	10 0
"	W.15	£17	0 0
"	W.15 CS	£17	10 0
GOODMANS Axiom	101	£6	12 1
"	102	£9	18 2
"	150 Mk. II	£10	5 6
"	22 Mk. II	£14	14 0
" Audiom	60	£8	12 6
" "	70	£13	15 0
" "	80	£22	10 0
" "	90	£28	0 0
W.B. HF.810		£3	5 6
HF.1012		£3	17 6

PICK-UPS

ACOS GP.20 Arm		£1	6 1
ACOS HGP39 Head Std. & L.P.	ea.	£2	2 3
COLLARO Standard Magnetic P.U.		£1	17 0
COLLARO Studio O or P. Pick Up		£3	14 8
COLLARO Transcription Arm Studio "P" Pick up		£4	15 9
COLLARO Transcription Arm Studio (Super) PX.		£5	2 5
B.J. Arm		£2	19 11
DECCA XMS Heads Std. or L.P.	ea.	£2	14 8
DECCA XMS P.U. with 2 heads		£6	9 5
CONNOISSEUR P.U. with 2 Heads		£9	5 6
CONNOISSEUR Transformer			13 0
CONNOISSEUR P.U. Heads. Diamond Stylus. Std. or L.P.	ea.	£7	8 11
LEAK Dynamic P.U. with Diamond Stylus		£11	9 6
LEAK Dynamic Extra Head		£7	15 3
Mu-Metal Transformer		£1	15 0

GRAM MOTORS

COLLARO 3/554 3 Speed Motor and Pick up		£8	18 4
COLLARO 2000 3 Speed Transcription Motor		£13	9 6
COLLARO 2010 3 Speed Transcription Motor and "P" Pick up		£18	4 9
GARRARD 301 3 Speed Transcription Motor		£25	3 6
GARRARD RC.80M 3 Speed Autochanger with 45 R.P.M. Post		£18	12 9
CONNOISSEUR 3 Speed Transcription Motor (Latest Model)		£25	15 5

G.E.C. METAL CONE SPEAKER

OCTAGONAL SPEAKER CABINET

Designed for the G.E.C. Metal Cone Speaker.
Price £12 10 0

R.J. SPEAKER CABINET

The sensational new miniature speaker cabinet by Wharfedale.
Price £9 10 0

TUNER UNITS

CHAPMAN S4.	Four Stage Feeder Unit	£16	0 0
" S5.	Five Stage Feeder Unit	£21	6 8
F.M.81 V.H.F. FM/AM Feeder Unit		£21	0 0

Postage & Packing extra.

TELE-RADIO (1943) LTD

189 EDGWARE ROAD, LONDON, W.2. Phone: PAD 4455/6

Shop hours: Monday-Saturday, 9 a.m. to 6 p.m. Thursday 9 a.m. to 1 p.m

Simon is Sound

When you listen to a Simon Portable you're hearing sound Recording at its lively best. Ask your dealer for a demonstration. Try its simple controls. Hear its faultless reproduction of speech and music—remember that for P.A. or record reproduction you can use the high quality amplifier independently of the recorder.

SIZE :..... 18in. × 15in. × 10in.
LOUDSPEAKER :..... 6½in. built-in Monitor.
POWER SUPPLY :..... 200-250 v. 50 cycles A.C.
INPUT CHANNELS :..... High impedance for microphone: low or high impedance for radio.
POWER CONSUMPTION :..... 100 watts approx.
RESPONSE :..... 50 -12,000 c.p.s. ±3db.

Simon

PORTABLE TAPE RECORDER MODEL SP/1 79 Gns.

★ Monomaster Finger-tip control
★ 2-stage capstan
★ Three motor drive
★ Fast rewind and wind-on
★ 10 watts push-pull output
★ Simple loading

Ask for illustrated literature, and information Sheet T1/6.

SIMON SOUND SERVICE LTD. (Dept. W.),
48-50 GEORGE ST., LONDON, W.1. Phone: WELbeck 2371 (5 lines)

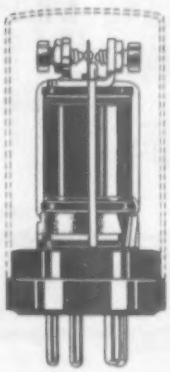
BROOKES Crystals for DEPENDABLE frequency control

● Illustrated above is a Type SJ Crystal Unit from a range covering 3-20 mc/s and on the right is a Type SM Crystal Unit from a range covering 3-20 mc/s.

All Brookes Crystals are made to exacting standards and close tolerances. They are available with a variety of bases and in a wide range of frequencies. There is a Brookes Crystal to suit your purpose—let us have your enquiry now.

BROOKES

Brookes Crystals Ltd
suppliers to Ministry of Supply, Home Office, B.B.C., etc.
181/3 TRAFALGAR ROAD, LONDON, S.E.10
Phone: GREenwich 1828 Grams: Xtals Green, London



Actual Size

Announcing the new Manning-Carr P.53C Miniature Polarised Relay.

Now in dust-proof heavy gauge anodised aluminium can and miniature 5-pin base for plugging in, thus protecting the relay and obviating wiring.

(original version still available).

DATA—A Sensitivity of 25 milli-watts and capable of handling mains voltage on the contacts with alternating currents up to 0.25 amps. Being polarised it has the advantage that the Armature contact can be biased to lock in either direction by suitable adjustment of the contact screws which provides a useful facility where pulse operation is required. Speed of operation is also high and the Relay will follow A.C. frequency of 50 c.p.s. Resistance up to 7,000 ohms which is acceptable for Anode circuits. Alternatives to specification if required. Sole Concessionaires.

POST OFFICE TYPES 3,000 AND 600 RELAYS

to specification. Tropicalising, impregnating and Services jungle finish if required. Delivery 3-4 weeks.

Manufacturers to H.M. Govt. Depts. and leading contractors

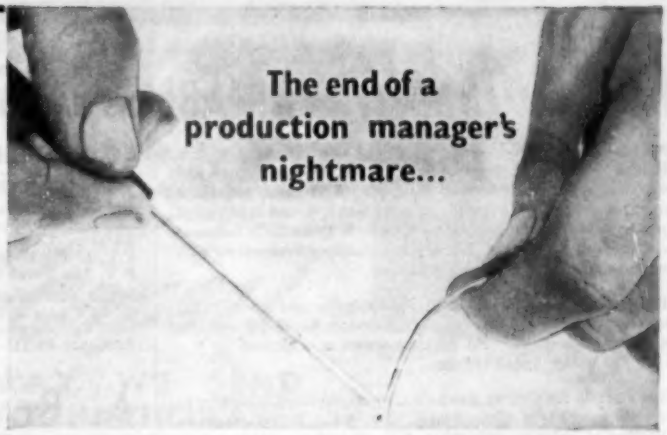
L. E. SIMMONDS LTD.
5, BYRON ROAD, HARROW, MIDDX.
Telephone: Harrow 2524-0315.

ORYX

miniature SOLDERING INSTRUMENTS

the smallest precision soldering instrument you've ever seen

No ceramics or mica are used in ORYX soldering instuments. Nothing to go wrong. Entirely designed and made in England for production line reliability and pin-point precision soldering



Model	Consumption	Voltage	Bit Diameter	Weight	Length	Price	Spare Bits
12	12 watts	6, 12, 24 or 50	3/16" (4.8 mm)	0.5 oz	6½"	£1 5 0	2/-
11*	10 watts	6 only	5/32" (4 mm)	0.5 oz.	6"	£1 15 0	7/6
9	8.3 watts	6, 12 & 24	5/32" (4 mm)	0.25 oz.	6"	£1 5 0	1/8
6A	6 watts	6 only	3/32" (2.4 mm)	0.25 oz.	6"	£1 5 0	1/8
6	6 watts	6 only	1/16" (1.6 mm)†	0.25 oz.	6"	£1 5 0	

* Special High Temperature Model † Fixed Bit

Sole Distributors :

ANTEX

3 TOWER HILL · LONDON · EC3 *Phone: ROYal 4439 Grams: (Overseas) "Antexlim, London"*
SUPPLIERS TO H.M. AND FOREIGN GOVERNMENTS, LEADING ELECTRONIC, HEARING AID, INSTRUMENT, RADAR, RADIO, T/V AND ELECTRO MEDICAL MANUFACTURERS, HOSPITALS AND UNIVERSITIES THROUGHOUT THE WORLD.

Cellular Polythene

75 ohm. T.V. DOWNLEAD CABLE
Nominal Attenuation at 50 Mcs 2.5dB 100 ft.

P.V.C Sheath

Plain Copper Wire Braid

Cellular Polythene Insulated to 0.129" Diameter

1/.029" Annealed Copper Conductor

A Glover Product

W. T. GLOVER & CO. LTD.
MEMBERS OF THE S.M.A.
TRAFFORD PARK MANCHESTER 17
TRAFFORD PARK 2141

Specialists in Plastic Extrusion

Connoisseur VARIABLE 3 SPEED GRAMOPHONE MOTOR

We present an entirely new three-speed unit operating at 33⅓, 45 and 78 r.p.m. The full 12in. turntable is lathe turned and manufactured of non-ferrous material. The main spindle is precision ground and lapped to mirror finish and runs in phosphor bronze bearings. The synchronous motor is dynamically balanced and resiliently mounted, making it virtually vibrationless, with low noise level and low hum induction.

The speed change is arranged mechanically and gives a 2% variation on all speeds, the synchronous motor running at constant speed at all settings. No braking action is employed ... to obtain speed change.

It is suitable for playing standard transcription and microgroove recordings. Input voltages 220/250 v. A.C. 50 cycles, or, as specified to order for 200/250 v. A.C. 60 cycles, or 110 v. A.C. 50 or 60 cycles. Mounted on ¼in. die-cast board 15½×13½in. with 3½in. clearance distance below motorboard. Speed selector turret is fitted at left rear of motorboard. On-off switch at left front also releases pressure on the rubber drive assembly. All motor boards are drilled to take Connoisseur Standard and Super Lightweight Pickups unless otherwise ordered. When used with these pickups mounted in position, 3½in. clearance above motorboard is recommended.

Price £19.0.0 Plus Purchase Tax £6.15.5. Total £25.15.5

CONNOISSEUR
Super Lightweight 3-head Pickup with Sapphire Stylus

Prices: Complete Pickup with one head (either Standard 78 r.p.m. or Microgroove 33⅓ or 45 r.p.m.), **£4/10/-** plus P.T. **£1/12/1: Total £6 2/1.** Each additional head **£2/10/-** plus P.T. **17/10: Total £3/7/10.** Replacement Armature **10/3** plus P.T. **3/8: Total 13/11.**

Fitted with Diamond Stylus, complete Pickup with one head **£7/12/9** plus P.T. **£2/14/5: Total £10/7/2.** Each additional head **£5/12/9** plus P.T. **£2/0/2: Total £7/12/11.** Replacement Armature **£3/13/-** plus P.T. **£1/6/-: Total £4/19/-.**

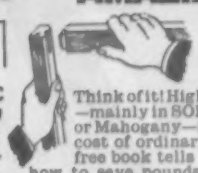
A. R. SUGDEN & CO.
(ENGINEERS) LTD.
WELL GREEN LANE, BRIGHOUSE, YORKSHIRE

Telephone: Halifax 69169. Telegrams: "Connoisseur Brighouse"

OVERSEAS AGENTS: **S. Africa:** W. L. Procter (Pty), Ltd., 63 Strand Street, Cape Town. **Australia:** J. H. Magrath & Co. Pty, Ltd., 208 Little Lonsdale Street, Melbourne. **Canada:** The Astral Electric Co. Ltd., 44 Danforth Road, Toronto 13, Ontario. **New Zealand:** Turnbull & Jones Ltd., Head Office, 12/14 Courtenay Place, Wellington. **Hong Kong:** The Radio People Ltd., 31 Nathan Road, Hong Kong. **Malaya:** (Main Distributors) Eastland Trading Co., 1 Prince Street, Sinzapore. **U.S.A.** (Main Distributors): Danby Radio Corporation, 2042 Chestnut Street, Philadelphia, 3, Pa. Audio Supply Laboratories, Nickels Arcade Buildings, Ann Arbor., Michigan.

New! Click! and it's in! AMAZING SELF-BUILD FURNITURE

PARTS FIT LIKE MAGIC SEE HOW EASY IT IS!



Anyone can make it! Saves Pounds! No skill, no special tools!

Think of it! High-grade furniture—mainly in SOLID Oak, Walnut, or Mahogany—for about half the cost of ordinary furniture! Our free book tells you just how it's done . . . how to save pounds with wonderful Furni-Kit. Absolutely no skill needed—just a screwdriver and hammer and you . . . your wife . . . anyone . . . can assemble it in no time. There's a whole range of lovely things for your home—everything from a luxury Needlework Cabinet on rubber-tyred wheels to a big Kitchen Cabinet. *The prices will astonish you.*

MAINLY IN SOLID OAK WALNUT OR MAHOGANY
Needlework Cabinets
Kitchen Cabinets
Tea Trolleys
Occasional Tables
Bookcases
Bedside Cabinets
Nursery Furniture
Bathroom Furniture
Etc. Etc.
SUPERB QUALITY

Send for fascinating FREE BOOK in colour

You owe it to yourself to read this remarkable book. Find out how you can save pounds and pounds with Furni-Kit and have furniture that is so much better. The book is fully illustrated with real photos and gives dimensions, details of easy terms—in fact, everything you'll want to know about this thrilling new idea. Send for your copy today—FREE.

YOU MUST READ THIS BOOK

Yes . . . Please send me free book.

NAME _____

ADDRESS _____

(WS/7)

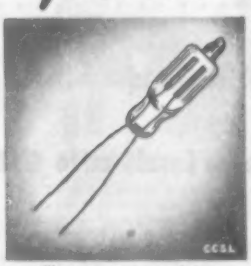
Free! FURNI-KIT
LUXURY SELF-BUILD FURNITURE

Dept. WS/7 29/31, Wright's Lane, Kensington, W.8

Parts fit like magic! No skill needed!

HIVAC INDICATOR LAMPS

Neon indicator lamps for electrical equipment



(illustrations are actual size)

For all A.C. or D.C. mains voltages - long life - negligible power consumption - extreme reliability

MAY WE SEND YOU A DETAILED FOLDER?

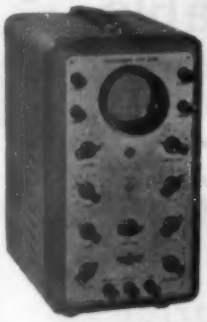
Hivac Limited

STONEFIELD WAY, VICTORIA ROAD, RUISLIP, MIDDLESEX

Telephone: Ruislip 3366

Two NEW 'Scopes!

Furzehill



MAY WE SEND YOU PARTICULARS?

Type O-120

Portable. Lightweight, High-sensitivity Audio 'scope. 4mV/cm. r.m.s. (max.). Push-pull Plate deflection. External terminal connections to "X" Amplifier and C.R.T. available. 3c/s to 25Kc/s.

Type O-100

Servo and General Purpose 'scope. 7mV/cm. r.m.s. (max.). Direct coupled, symmetrical "X" and "Y" Amplifiers. Triggered Time Base. Time and Voltage calibration. D.C. to 4Mc/s.

Furzehill Laboratories Ltd.

57, CLARENDON ROAD · WATFORD · HERTS. *Cables: FURZLAB, LONDON.* *Tel.: Godebrook 4686/7*

LANE Makes Tape Recording History

with the TWO SPEED TAPE UNIT Mk VI

Never before has a Tape Unit of such advanced design been offered at the amazingly low figure of £18 10s. Precision engineered and exquisitely finished the Lane Mark V represents unprecedented value in the realm of Tape Recording. Attractive discounts are available to quantity buyers. Note these special features.

- ★ **Three high-grade motors.**
- ★ **Single knob control, electrically and mechanically interlocked.**
- ★ **Drop-in tape loading.**
- ★ **Automatic brakes.**
- ★ **2 speed 7½in./sec. 3¾in./sec.**
- ★ **Speed change at turn of a key.**
- ★ **Twin track.**
- ★ **British Standard Specification.**

Write for full details to

VERDIK SALES LTD. 8, RUPERT COURT, WARDOUR STREET, LONDON, W.1. *GERrard 8266*

NEW! and NOW available...

FERROVOICE
PLASTIC TAPE

Incorporating all the latest developments in tape production

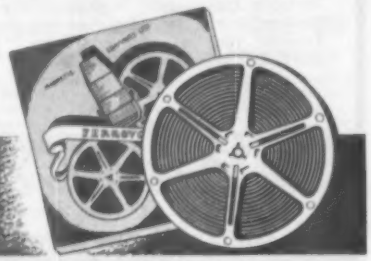
PRE-STRETCHED PVC
BROWN OXIDE
HIGH OUTPUT
LOW BACKGROUND NOISE
EASE OF ERASURE
HIGH TENSILE STRENGTH
NON-CURLING

The QUALITY tape at a competitive price...

32/6 per 1200 ft spool

On the well-known universal Ferrovoice Spool

600 ft 19/6
300 ft 12/6



The popular FERROVOICE PAPER TAPE is still available

MAGNETIC COATINGS LIMITED
38 GROSVENOR GARDENS LONDON SW1 Telephone: SLOANE 9129
WORKS & LABORATORY: 25 DASHWOOD TRADING ESTATE
LARCH ROAD LONDON SW12 BALHAM 5579

INSIST ON HIFI

Type H0/500 } 20-20,000 cycles
Type H0/60 }

Type H0/500A } 20-40,000 cycles
Type H0/60A }

for Precision Oscillators

Type H0 60 giving 0.06 watts output
Type H0 500 giving 5 watts output

- ★ Scale Calibration Accuracy of 1%.
- ★ Supplied in 2 Standard Frequency Ranges.
- ★ Output Voltmeter Fitted.
- ★ Built-in Attenuator.
- ★ High and Low Impedance Output.

Hifi REG'D TRADE MARK

Look for the Registered Trade Mark

Hifi Ltd. DERRY ST., BRIERLEY HILL, STAFFS. Telephone: Brierley Hill 7604

Completely New & Unique
Battery/Spring driven

MINIATURE RECORDER
A.C.E. "CONSORT"

SIZE : 6½" × 7" × 12". NO LARGER THAN A TELEPHONE

Provides foolproof "quality" recording anywhere WITHOUT MAINS POWER

MANY "ALL MAINS" FEATURES INCLUDE:

★ 2 TRACKS ★ POWER REWIND
★ AUTOMATIC ERASE ★ MONITORING CIRCUIT ★ 3 SPEEDS ★ 5in. SPEAKER

(Full Trade and Export Terms.)

£52
With Tape, Batteries and Microphone

CALL FOR DEMONSTRATION OR SEND FOR ILLUSTRATED BROCHURE

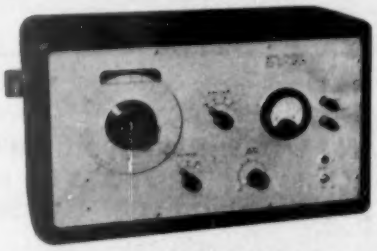
ASSOCIATED CINE EQUIPMENTS LTD.
353, BEXLEY ROAD, ERITH, KENT. Phone: ERITH 2543

PRECISION EQUIPMENT
for radio and electronic engineers

All-purpose test set enabling the simultaneous measurement of current and voltage.

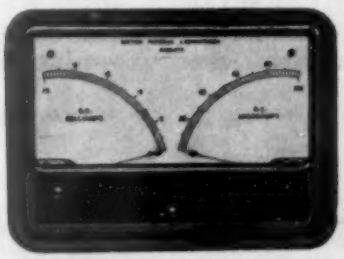
D.C. Milliameter measuring only 5in across, yet retaining a scale length of 9in.

Three-range Probe Millivoltmeter with self-contained stabilised power pack. Automatic overload protection.

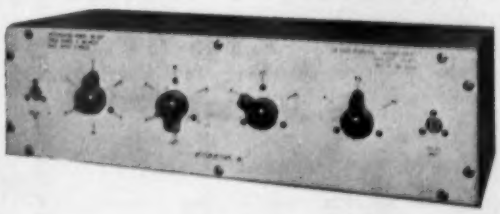


Audio-frequency Signal Generator operating from A.C. Mains. Frequency range: 50 cycles to 55,000 cycles.

Universal Valve Voltmeter with all-range indicator measuring from D.C. to U.H.F.



High sensitivity double-purpose meter for panel mounting. Movements are independent of each other.



Wide frequency range attenuator with incremental accuracy within 1% up to 70 Mc/s. Backed by N.P.L. certificate.

BRITISH PHYSICAL LABORATORIES

Radlett, HERTS *Tel : RADLETT 5674-5-6*

dmBP31

'SCOTCH BOY'
REGD. TRADE MARK
MAGNETIC RECORDING TAPE

ANOTHER 3M PRODUCT

MINNESOTA MINING & MANUFACTURING CO. LTD
Arden Rd, Adderley Park, Birmingham 8 — 167 Strand, London WC2
90 Mitchell St, Glasgow C1 — 16 Mosley St, Manchester 2

We are glad to announce

the immediate availability of "Scotch Boy" Magnetic Recording Tape on a new clear plastic 7" reel—more solid, perfectly balanced, with a large centre hub and simplified V slot threading.

Each new reel has its own sturdy handsome hinged box, in our familiar black and plaid, with ample writing space on the underside.

As for the tape, it will "speak for itself." On all types of recorders it will give true, brilliant quality. It is an all-British product of which we are proud.

Daily, professional and home recordists alike are changing to "Scotch Boy."

ELEMENTS OF
RADIO SERVICING
(2nd Edition)

William Marcus and Alex Levy

This book gives practical step-by-step procedures for diagnosing troubles in radio receivers and in making the repairs. It presents the information so that the student with a background of simple radio theory can understand it and emphasizes procedures which may be applied to any receiver.

All the latest types of receivers are covered including battery and threeway portables.

The new edition is greatly enlarged, contains new illustrations, and will be invaluable to service repair men.

9 x 6 inches. Approx. 520 pages. Approx. 40s.

Available shortly from your bookseller

McGraw-Hill · London

HUNTON will cut your press tool costs for PROTOTYPE and PRE-PRODUCTION RUNS!

THE UNIVERSAL BOLSTER OUTFIT USING STANDARDISED PUNCHES AND DIES FOR SHEET METAL PIERCING AND BLANKING ON FLY PRESSES

STUDY
THESE ADVANTAGES!

- Specialised range of Chassis Piercing and Forming Tools for the Radio and Electronics industries.
- To cut you started—standardised Punches and Dies ¼in. to 2½in. dia. in 1/32in. sizes from stock.
- At short notice, standardised Tools or square, oblong, and other shapes.
- Adjustable Gauges for exact location of work. Automatic and Positive Stripping of material from Punch.

If in London and Home Counties, ask for a practical demonstration in your own works. Alternatively, write for illustrated price list to:

HUNTON LIMITED, PHŒNIX WORKS,
114-116, EUSTON ROAD, LONDON, N.W.1.
Tel.: EUSton 1477 (3 lines). Grams: Untoneth, London.

RELAYS

AMERICAN RELAYS FOR OFFSHORE CONTRACTS

We are already tooled to manufacture many types of these relays, and through our association with the Guardian Electric Manufacturing Company of Chicago, we have access to full information on other types.

ENQUIRIES ARE INVITED

PHONE: NEWMARKET 3181-2-3 TELEGRAMS: MAGNETIC NEWMARKET

MAGNETIC DEVICES LIMITED

MAGNETIC DEVICES LTD
EXNING ROAD, NEWMARKET

M.D.7A

ACCLAIMED... BRITAIN'S FINEST AUDIO REPRODUCER

Type T.P.I **£96** as illustrated. Finished walnut or light oak. Ex works.

★ Built as a musical instrument, sounds like a musical instrument.
★ Entirely new development in electrical-mechanical-acoustical system.
★ The most efficient reproducer of audio frequencies in the world with a single drive unit compound horn housing.
★ **Now used by Television, Broadcasting and Recording Studios throughout the World, as standard monitor.**

LOWTHER F.M. TUNER

Tunable over V.H.F. Band II. Quality reception guaranteed from Wrotham and other sites when ready.

Price **£22**
Plus purchase tax **£7 6.4**

LOWTHER MOVING COIL PICK-UPS

Fitted with diamond stylus. Std. or L.P. ..... **£9/10/-** (plus £3/3/3 P. Tax)
Fitted with sapphire stylus. 33⅓ and 45 r.p.m. or 78 r.p.m..... **£5/10/-** (plus £1/16/7 P. Tax)

THE LOWTHER MANUFACTURING COMPANY, LOWTHER HOUSE, ST. MARK'S RD., BROMLEY, KENT, ENGLAND
Tel.: RAVensbourne 6225

Valuable Wireless World *books*

Radio Interference Suppression

As applied to Radio and Television Reception. By G. L. Stephens, A.M.I.E.E. Explains the origins of electrical interference and principles of suppression, then gives practical details of suppression methods for many kinds of industrial, domestic and marine equipment.
8¼in. + 5¼in. 132 pp. Illustrated. 10s. 6d. net. By post 10s. 11d.

Television in Your Home

Everything the potential viewer needs to know. By W. E. Miller, M.A. (CANTAB.), M.Brit. I.R.E. Provides all the information needed by viewers before and after the purchase of a receiver. Entirely non-technical, the book assumes no previous knowledge whatever of television. Gives invaluable information on buying, installing and using a television set.
7¼in. + 4¼in. 64 pp. Illustrated. 2s. net. By post 2s. 2d.

Wireless World Television Receiver Model II

Collected articles describing a complete receiver, using a superheterodyne circuit, which provides a modern standard of performance and is suitable for home construction. Complete constructional details, with all circuits and many photographs.
10¼in. + 7¼in. 40 pp. 3s. 6d. net. By post 3s. 9d.

Wireless World Diary 1955

Compiled by the technical staff of "Wireless World," the reference section includes much valuable information of handy formulae, abacs, charts and valve base tables giving connections for over 500 valves. Ample room for notes, one-week-to-an-opening diary.
Rexine (inc. P.T.), 4s. 1d. By post 4s. 3d.
Leather (inc. P.T.), 5s. 10d. By post 6s.

Obtainable from booksellers or direct from :

Iliffe & Sons Limited, Dorset House, Stamford St., London, S.E.1

METERS

LARGE AND VARIED STOCKS AVAILABLE FOR IMMEDIATE DELIVERY

EXAMPLES FROM OUR RANGE OF 2½" FLUSH PATTERN MOVING COIL INSTRUMENTS (as illustrated)

AMPERES D.C. 0-1, 2, 3, 5, 10, 15, 20, 25, 30, 50.
MILLIAMPS. 0-1, 1-0-1, 0-5, 10, 15, 20, 25, 30, 50, 100, 250, 500.
MICROAMPS. 0-50, 100, 200, 250, 400, 500, 750, 50-0-50, 100-0-100, 250-0-250, 500-0-500.
MILLIVOLTS. 0-10, 25, 50, 75, 100, 500.
VOLTS D.C. 0-1, 5, 10, 15, 25, 50, 100, 250, 500, 750, 1,000.
VOLTS A.C. 0-5, 10, 15, 25, 50, 100, 250, 500, 750, 1,000.

We can supply meters with NON-STANDARD CURRENT and VOLTAGE RANGES to any specification. DELIVERY 7-14 days.
MOVING IRON, THERMO & ELECTROSTATIC INSTRUMENTS ALSO AVAILABLE.

ANDERS ELECTRONICS LTD.
91, HAMPSTEAD ROAD, LONDON N.W.1.
Telephone: EUSton 1639
Supplied to Government Departments, B.B.C., Leading Manufacturers & Research Laboratories

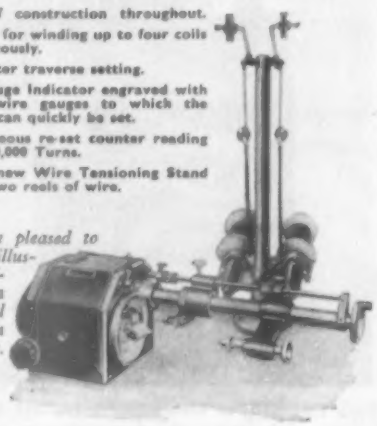
AUTOMATIC COIL WINDING MACHINE

Type A1/1. (25-50 S.W.G.) Type A1/X. (19-46 S.W.G.)

This machine is the most modern on the market and it possesses many exclusive refinements including:

- **Dustproof construction throughout.**
- **Provision for winding up to four coils simultaneously.**
- **Micrometer traverse setting.**
- **Wire Gauge Indicator engraved with various wire gauges to which the machine can quickly be set.**
- **Instantaneous re-set counter reading up to 100,000 Turns.**
- **Entirely new Wire Tensioning Stand to hold two reels of wire.**

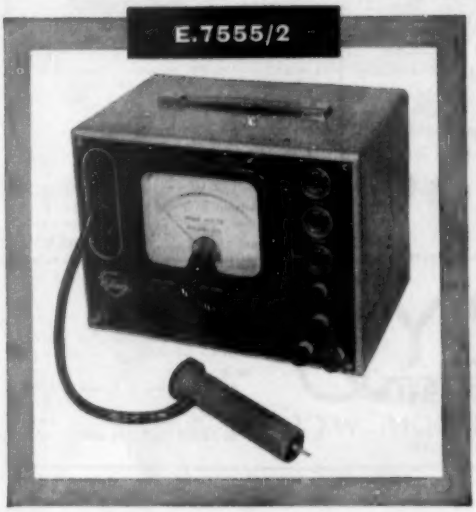
We will be pleased to send you an illustrated leaflet giving a full technical specification on request.



KOLECTRIC LTD
73 UXBRIDGE ROAD, EALING, LONDON, W.5
Ealing 8322

new VALVE VOLTMETERS

by Mullard



E.7555/2

WIDE RANGE

0.5V to 15kV F.S.D., peak a.c. or d.c. (an alternative model, **E.7555/3**, with a range of 0.5V to 500V is also available).

BROAD BANDWIDTH

Low level response within 2% from 30 c/s to 100 Mc/s using probe.

EXTREME STABILITY

The high degree of feedback employed minimizes the effects of ageing and supply fluctuations.

"FLOATING" REFERENCE POTENTIAL

Voltages may be measured both positive and negative to earth or other reference potentials.

DIFFERENTIAL MEASUREMENT

Provision is made for differential measurement of direct voltages and, at the same time, for the input resistance to be balanced to earth.

E.7556

SENSITIVE

F.S.D. readings range from 10mV to 300V a.c.

FLAT FREQUENCY RESPONSE

Only 2% (0.2dB) variation between 20 c/s and 1 Mc/s.

ACCURATE

Absolute error is less than 4% over whole range.

NEGATIVE FEEDBACK

As in the E.7555 series the calibration accuracy is precisely maintained.

BUILT-IN CHECK VOLTAGE

A stable 10mV supply provides a quick and easy check of calibration.

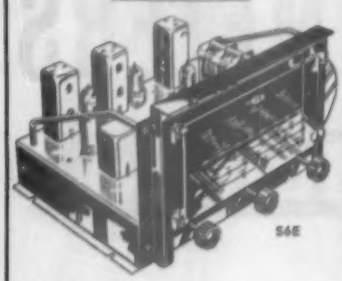
Mullard

SPECIALISED ELECTRONIC EQUIPMENT

Write today for full information on valve voltmeters and other instruments in the Mullard range

MULLARD LIMITED · EQUIPMENT DIVISION · CENTURY HOUSE · SHAFTESBURY AVENUE · LONDON · WC2
(M1495)

CHAPMAN



S6E

S6E 4 Waveband 12.5 m.-550 m., with R.F. stage; var. selectivity. £30.

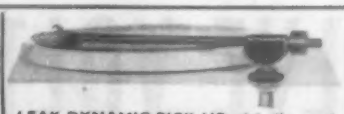
S5 3 Wave Bands, 16 m.-2,000 m., R.F. pre-Amplifier, variable selectivity I.F. Delayed amplifier A.V.C. very low distortion. £21/6/8.

S5E As S5 but 12.5m.-550m. £21/6/8.

S4 The Standard high-quality Feeder Unit Specification as S5 but without R.F. amplifier. £16.

FM81 For the new F.M. Broadcasts. Amaz'ing degree of realism with complete absence of background noise. £21.

TRANSISTORS
Point Types 30/-
Junction Types 40/-



LEAK DYNAMIC PICK-UP with diamond stylus.
Arm with L.P. or 78 head £11 9 6
Extra head £7 15 3
Mumetal cased trans. £1 15 0

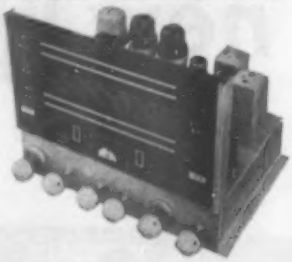
ALL SPECIFIED COMPONENTS FOR: Osram 912, Mullard 10 watt, and Williamson Amplifiers and Amos & Johnson F.M. Unit.

"Q-MAX" CHASSIS CUTTERS
STILL the easiest and quickest way of cutting holes in **SHEET METAL**

Patent No. 619178.

⅜" or ½" ... 11/6
⅝" 12/6
¾", 1" or 1¼" 14/9
1½" or 1¾" 16/6
2" 18/6
2¼" 30/-
2½" 35/-
1" square 22/-
Keys, small, 10d.; medium, 1/3; large, 1/9.

THE NEW ARMSTRONG F.C. 48



8 Valves, incl. 2 double triodes. 8 watts output. Provision for using FM. adaptor. Separate Bass and Treble controls. 2 Shorts, medium and long wavebands £33 18 0
Or £8 dep. and 29/2 monthly.

SOUND SALES
Phase Inverter Speaker £14 10 0
Junior A-Z Amplifier £20 0 0
A-Z Radio Unit £17 4 0
F.M. Unit (incl. aerial) £20 18 2

BERRY'S
(SHORT WAVE) LTD.
25 HIGH HOLBORN, LONDON, W.C.1
TEL: HOLBORN 6231

NEW SPEAKERS
G.E.C. Metal cone, 6 watts, 30 c/s.-20 kc/s..... £8 15 0
W.B. HF812. 8in., 5 watts, 50-12,000 cps., 3, 7½ and 15 ohms £3 5 6
WB. HF1012. 10in., 10 watts, 30-14,000 cps., 3, 7½ and 15 ohms. £3 17 6

M. R. SUPPLIES Ltd.

F.H.P. GEARED MOTORS FROM STOCK!
FIRST-CLASS UNITS FOR IMMEDIATE DELIVERY FROM LARGEST STOCKIST IN LONDON

GEARED MOTORS. 220/250 v. 50 c. 1 ph., capacitor/induction, by best makers, continuously rated. Final shaft 200 r.p.m. (16 lbs./ins. final torque) and motor shaft 1,440 r.p.m. brought out for use. Overall length 7in. Leads brought out for reversing. Splendid opportunity, £4/10/- (des. 2/6).

GEARED MOTORS. Large choice of brand new units, off the shelf! All with leads brought out for reversing, all continuous rated:—Series wound, 220/240 v. A.C./D.C. final speed 100 or 50 r.p.m., overall length 6½in., either £5/17/6 (des. 2/6). Final speed 10 or 1 r.p.m., overall length 8in., either £6/18/6 (des. 2/6). Capacitor/Induction, 100 r.p.m., 46 r.p.m., 33 r.p.m. and 17 r.p.m., with capacitor, £8/17/6 (des. 2/6). Also Cap./Ind. High duty models, 60 r.p.m. (55 lbs./ins.), overall length 8in., £10/18/6, also same model 20 r.p.m., same price. Also 10 r.p.m. and 1 r.p.m. (80 lbs./ins.), overall length, 10in., either £14/10/- (des. 5/-). And many others. Please send us your *F.H.P. Geared Motor* enquiries. We are supplying many of the large industrial firms.

CAPACITOR/INDUCTION MOTORS (Croydon), 220/240 v. 50 c. 1 ph. rated 1/40th H.P., 1,440 r.p.m., fitted 1¼in. pulley, in original cartons, with correct capacitor, 55/- (des. 2/6). Also series wound, 1/30th H.P., 220/240 v. A.C./D.C., 4,000 r.p.m., ideal for cine projectors, stirrers, sewing machines, etc., £3/15/- (des. 2/-).

INDUCTION MOTORS (split-phase start), 220/240 v. 50 c. 1 ph. (with provision for 110 v.). One-quarter H.P., 1,425 r.p.m. Length of body 9in., diameter 6in., brand new, £4/5/- (des. 5/-).

SEWING MACHINE MOTOR OUTFITS (Complete). Really high quality job at about half usual price. 220/250 v. A.C. D.C., including motor, foot control, needle light, belt, etc., with instructions for easy installation on any machine, £6/15/- (des. 2/6).

DUAL READING D.C. VOLTMETERS (2in.), 0/10 and 0/200 v. Pocket type with leads, 200 ohms/volt, new, boxed, 8/6 (des. 9d.). **AMMETERS** 0/5 amps. D.C., 2in. panel mount, 6/6 (des. 9d.).

SMALL VARIABLE RESISTANCES. For F.H.P. motor control or cine motors. 250Ω, 25 w., made by OHMITE. Rotary type only 1¼in. dia., with ¼in. shaft, ¼in. prof., 4/6.

INSTRUMENT RECTIFIERS. We have a limited supply, new, ex well-known makers, full-wave 5 mA. copper oxide, 2/6.

STUD-TAP POTENTIOMETERS (25,000 ohms). In demand for the 27-stud precision switch, approx. 1in. radius, 7/6. **TERMINAL STRIPS.** 20 heavy brass terminals (with captive heads) on moulded strip 1½in. long by 2½in. wide, each pair numbered 1 to 10. Ideal for distribution, bomb-ups, etc., 2/6 (des 1/-)

AIR THERMOSTATS. (Brand new product of first-class manufacturer) Range 35/75 deg. F. (differential only 2 deg. F.). Capacity 15 amps. (250 v. A.C.). In neat housing 4in. × 2in. × 2in., and substantial value at 35/- (des. 9d.).

SMALL GEAR BOXES. Double worm gear, 300/1 reduction, in die-cast housing, 2¼in. × 2¼in. × 2in. Final shaft ½in. dia. by 1½in. proj. Ball bearings transmission up to 1/10th H.P. 45/- (des. 1/6).

SYNCHRONOUS ELECTRIC CLOCK MOVEMENTS. (Again in stock!). 200/250 v. 50 c., with spindles for hours, minutes and central seconds hands, in plastic dust cover 3½in. dia., 2½in. deep, with flex, ready for use, 27/6 (des 1/-). Set of three hands, in good style, for 8/7in. dial, 3/-.

We are stockists of **Philips Variable Transformers, Sinari Electric Pumps, G.E.C. Metal Cone Speakers.**

M. R. SUPPLIES, Ltd., 68 New Oxford St., London, W.C.1.
Telephone: MUSeum 2958

BRADMATIC LTD.

HIGH QUALITY TAPE RECORDING EQUIPMENT

THE MODEL 5D TAPE DESK (to take 10½in. NAB Reels)
Programme Time: 62 minutes at 7½ i.p.s.
124 minutes at 3¾ i.p.s.
Panel size: 20in. x 14½in.
Two speeds, 3¾ and 7½ i.p.s. Double track heads. Push button control. Fast wind and rewind. Three heavy duty motors. Three separately shielded heads. Complete with NAB reel adaptors.
PRICE: (fitted with 6RP heads) £50/-/-.

ALSO AVAILABLE

MODEL 5C TAPE DESK (to take 9in. Reels)
Programme Time: 55 minutes at 7½ i.p.s.
110 minutes at 3¾ i.p.s.
PRICE: (fitted with 6RP heads)
Large Panel (20in. x 14½in.) £47/10/-.
Small Panel (13½in. x 15½in.) £45/10/-.

MODEL 5B TAPE DESK (to take 9in. Reels)
Programme Time: 31 minutes at 7½ i.p.s.
62 minutes at 3¾ i.p.s.
PRICE: (fitted with 6RP heads)
Panel size (13½in. x 15½in.) £42/-/-.

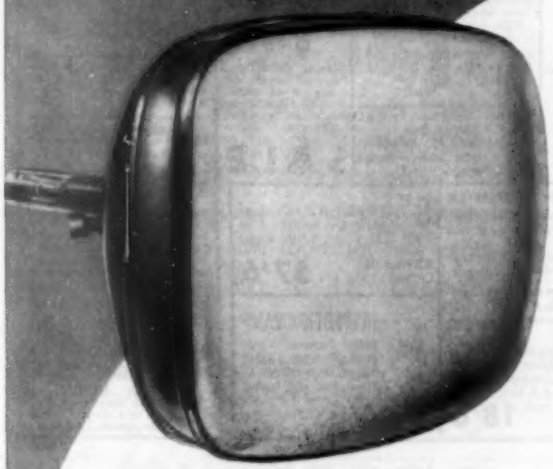
PORTABLE RECORDERS
In rexine covered case, fitted with model 5B tape desk, type D.2. C.J.R. amplifier with monitoring. Provision for external loud speaker.
PRICE: £117/-/- (without microphone)

High fidelity sound heads. Type 5RP (Record/Play) £3/5/-. Type 6RP (super fidelity), £3/15/-. Type 5E (Erase), £3/5/-. Mumetal Screening cans, 8/6. Amplifiers, microphones. All types and sizes of magnetic tape.

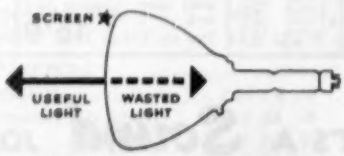
Trade supplied *Send for lists.*

BRADMATIC LIMITED
STATION ROAD · ASTON · BIRMINGHAM 6
Telephone: East 2881-2 *Grams: Bradmatic, Birmingham*

This ALUMINIZED Picture tube gives

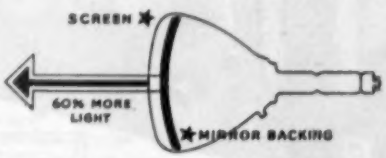


60% brighter pictures
more contrast
extra tube life



WITHOUT ALUMINIZING

Without aluminizing, tubes waste half their light (see diagram above). To counteract this the brilliance must be increased and the tube life is shortened.



WITH EDISWAN ALUMINIZING

Ediswan aluminized tubes have a mirror backing to the screen. All the light is thus thrown forwards giving brighter, clearer pictures and extra life.

AN Ediswan Mazda aluminized picture tube gives a picture 60% brighter and more contrasty than is possible with an ordinary tube.

In addition, Ediswan aluminizing protects the screen from ion burn and, with the new Ediswan ion trap tetrode gun to protect the cathode, tube life is increased.

Ediswan production methods, which include the special in-line vacuumizing system, ensure a higher, more uniform standard of lasting efficiency. For complete satisfaction demonstrate and recommend Ediswan Mazda aluminized picture tubes.

EDISWAN
MAZDA

ALUMINIZED CATHODE RAY TUBES

THE EDISON SWAN ELECTRIC COMPANY LIMITED,
155 Charing Cross Road, London, W.C.2 and Branches.
Member of the A.E.I. Group of Companies.

RVP

NATION WIDE SERVICE

6 fully equipped cathode ray tube service depots provide better, quicker tube testing should the need arise. Stocks of tubes are available in 26 Ediswan Offices. Only Ediswan give such complete backing to the Trade.

Great Britain's Valve Mail-Order House

One Year's Guarantee

1R5	16/5	ECC40	22/1
1S4	14/6	ECC81	22/1
1S5	16/5	ECC82	22/1
1T4	14/6	ECC83	22/1
3S4	14/6	ECC91	31/6
3V4	14/6	ECH3	22/6
1A7GT	18/11	ECH35	20/2
1C5GT	14/6	ECH42	20/2
1H5GT	14/6	ECH81	20/2
1N5GT	14/6	ECL86	23/4
2A4	18/11	EF9	19/6
2A5	21/6	EF37A	22/1
3Y5GT	13/5	EF39	16/5
5A4	15/1	EF40	22/1
6AL5	11/4	EF41	16/5
6AQ6	16/5	EF42	22/1
6AT6	15/1	EF50	22/1
6AU6	22/1	EF80	22/1
6BA6	14/6	EF91	22/1
6B8G	20/2	EF93	16/5
6J6	31/6	EK32	22/6
6BA7GT	20/2	EK90	20/2
6BK7GT	16/5	EL33	20/2
6BQ7GT	15/1	EL34	16/5
6V6GT	16/5	EL37	22/1
6X4	13/5	EL38	25/6
6X5GT	13/5	EL41	16/5
12AT7	22/1	EL42	16/5
12AU7	22/1	EL84	16/5
12AX7	22/1	EL90	16/5
12BA7GT	20/2	EM1	16/5
12SK7GT	16/5	EM4	16/5
		EM34	16/5
12SQ7GT	15/1	EY51	25/2
		EZ35	13/5
25L6GT	16/5	EZ40	13/5
35Z5GT	13/5	EZ80	13/5
50L6GT	16/5	EZ90	13/5
80	13/5	GZ34	18/11
AZ1	13/5	PL81	22/1
AZ31	13/5	PL82	16/5
AZ50	13/5	PL83	22/1
CBL1	22/1	PY80	15/9
CL4	20/2	PY81	16/11
CY1	20/3	PY82	13/5
KA36	11/4	UAF41	16/5
KABC80	9/5	UBC41	16/5
KAF42	17/8	UBL21	20/2
KBC30	15/1	UCH21	20/2
KB41	11/4	UCH42	20/2
KB91	11/4	UF41	16/5
KBC33	15/1	UF42	21/7
KBC41	15/1	UL41	16/5
KBF80	16/11	UL44	25/2
KBL1	22/1	UY41	13/3
KBL21	20/2	Post	9d.

SALE (2,000 191 TYPES) VALVES FROM 2/-

OZ4	6/-	954	2/-
01A	3/-	955	4/-
1H6	3/-	957	10/-
1LN5	7/-	1177Z6	7/-
3A6	2/-	1299A	7/-
3A7	3/-	1625	9/6
2B7	2/-	DD207	4/-
6A7	11/-	EF8	17/6
6AG7	10/-	HL1320	5/-
6E5	11/-	MSP41	5/-
6H9	14/-	P2	3/-
12A	2/-	P215	2/-
12SF5	6/-	31	2/-
13FA	5/-	ARP3	7/-
32	3/-	ARP4	5/6
34	3/-	ARP12	3/-
46	4/-	CV1134	5/-
50Y6	8/-	VR18	5/-
71A	2/-	VR65	2/-
884	21/-	Post 9d.	

VALVE OF THE MONTH

American 4 pin U.X. type No. 31. Triode Class A. Amplifier. 2.0 w. .13 amps (Full characteristics on request.) only **2/-**

METERS on **EASY TERMS** ask for Catalogue

VOLUME CONTROLS

5000	ohm.	¼	Meg.
10000	,,	½	,,
20000	,,	1	,,
25000	,,	2	,,
50000	,,		
100000	,,		

Less switch 4/6. S.P. sw. 6/4. D.P. sw. 7/10. Post 6d.

HEADPHONES

Lightweight High Resistance 4000 ohms complete with cord.

Post 1/-. **16'9**

ELPICO AC30 AMPLIFIER

3 valves incorporating power supply for radio tuner via international octal socket. Special matching for standard or L.P. records not required.

A.C. only **£7.19.6**

BIB Recording Tape Splicer is a precision-made device combining features of 5 U.S. makes at fraction of cost. **18'6**

DEMOBBED Valves "Manual" 2/3

Giving equivalents of British and American Service and Cross Reference of Commercial Types with an Appendix of B.V.A. Equivalents and Comprehensive Price List. We have still some Valves left at very old Budget Rates (33⅓%) which are actually sold at the old price. (1951 rate.)

PIFCO

All-in-one Radio-meter A.C./D.C. Tests everything in Radio. Complete with Test prods. **29/6.** Post 1/6.

TYANA TRIPLE THREE

Small Soldering Iron Latest development. Complete with detachable bench stand, **19/6.** Post 1/-.

RADIO BULLS VALVES

246 HIGH ST. HARLESDEN NW10

10/- Post 1/6

"WONDER" HAND TOOL

6 TOOLS IN ONE

Reduced from 20/-. Punches, bends and shears Metal Strip, Rod and Angle. Every Handyman needs one! 1,000 used. Unique!

SALE

MAX

Chassis Cutters with Keys

The easiest and quickest way of cutting holes in sheet metal. The cutter consists of three parts: A die, a punch and an Allen screw. The operation is quite simple. Prices incl. key: ⅛in. 12/4; ¼in. 12/4; ⅜in. 13/4; ½in., ⅝in. and ¾in., 16/- each; 1in. and 1¼in., 18/- each; 1½in., 19/9; 2½in., 21/9; 2½in., 24/9; 3in. square, 24/3. Post 1/-.

ROD Antennæ, 4ft. sections interlocking and extending, copper plated steel. BARGAIN. Doem **2/6**

B.T.H. GERMANIUM CRYSTAL DIODE. Complete with Blueprint and operating instructions, **2/-**

7/6 REDUCED FROM 21/- **7/6**

Pre-heated Electric Soldering Irons. 24 v. 36 Watts. Press button switch fitted. Corrosion-free Bit. Specially designed for fine work. Limited quantity.

SERVICE SHEETS

The one you require enclosed if available in a dozen assorted of our best choice, **10/6.**

9" TUBE CRT 516 Magnetic 4 v. heater, 4 to 5 kV. E.H.T. Int. Octal Base.

BARGAIN, Carr. & Crate, 4/6. **57'6**

INSPECTION LAMP

With stout galvanised wire guard. Superior quality. (Less flex and bulb).

6'6 Post 1/-.

IT'S A *Sound* JOB

unitelex M.G.4. AMPLIFIER

A low-cost general-purpose amplifier of outstanding performance and distinguished appearance. Output is 5 watts, with matching for 15 ohm and 3 ohm speakers. Input is switched for pickup (90 mV) or microphone (30 mV). In gramophone condition, distortion is 0.8% for 3 watts output at 1 kc, and frequency range is 40/30,000 cycles ± 3 dbs, 20 db of negative feedback being employed. B.V.A. valves used throughout.

Price, in chassis form (Type No. MG4), 8½ **guineas**; with cover and baseplate (Type No. MG4A), 9½ **guineas**.

Available from leading stockists, including the following in the London area: Messrs. Arthurs (Arthur Gray Ltd.); Berry's (Shortwave) Ltd.; City Sale and Exchange Ltd.; Clyne Radio Ltd.; Garland Bros. Ltd.; Mail Order Supply Co.; Nusound Products; Tele-Radio (1943) Ltd.; Webb's Radio.

unitelex (london) ltd. Pagnell St., London S.E.14. TIDeway 584.

TV TRANSFORMER TROUBLES?

"REWIND & REPLACEMENT HANDBOOK"

is now available. An entirely new handbook which every television engineer and dealer should have. It contains exclusive editorial matter on Line Output transformers and many manufacturers' modifications. The most complete catalogue of Manufacturers' Spares in Great Britain.

1/3 *(plus 3d. postage)*

UNISCAN I *Left*

The first of a series of universal line output transformers. A complete set of these transformers will cover 80% of British T.V. sets manufactured to date

39/- *(plus 2/- post and packing)*

Trade Terms upon request.

NURAY Mk. II

The Heater-Booster/Isolator unit that just plugs in. Gives low emission C.R.T. a new ray. Available for 2 volt C.R.T.

27/6 *(plus 1/6 post and packing)*

With Direct T.V. Replacements you need never be at a loss for a T.V. Transformer. We despatch your order by return. When out of stock we rewind faulty components.

Terms of business are C.W.O., C.O.D. or Pro Forma.

direct TV REPLACEMENTS

134/136 LEWISHAM WAY · NEW CROSS · S.E.14 · TIDeway 3693-2330

CLASSIC

FIRST IN THE QUEUE
(*if any*)

Nowhere can you get the selection of radio and gramophone equipment, nowhere can you get the service that we at Classic can give you. We always carry large stocks of the newest, most up-to-date equipment as soon as it becomes available. Some of the very new equipment is in short supply, but no matter how new or how scarce (or how expensive) it may be, we order it immediately. We don't wait until customers ask us for it. Which means one of two things. Either we have it in stock at once, or, if there is a waiting list, we—and our customers—are at the top of it. And you don't need to call—post enquirers receive the same careful attention as personal shoppers, and very favourable Hire Purchase terms are available to all.

The Classic Service is particularly valuable if you are an overseas customer. You can choose your equipment from our new Special Export Catalogue, which will be sent on receipt of 1/- for postage (airmail extra), and you can be sure that your equipment will arrive at the right time and in the right condition.

Here are a few of the newest pieces of equipment available now from Classic

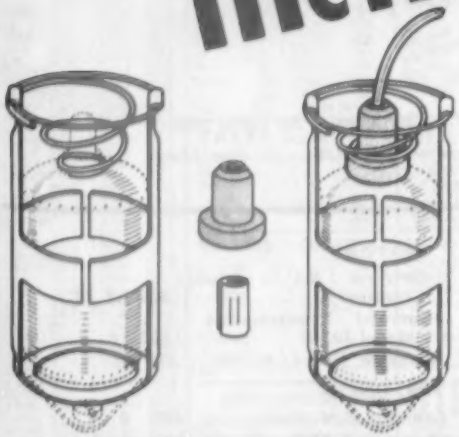
MOTORS	
Garrard R.C.90 Auto-changer	£22 8 11
Garrard Transcription Model 301/B	£25 4 6
Variable Speed Motor	£25 15 5
F.M. UNITS	
Lowther F.M. Unit	£29 6 4
Chapman F.M.81	£21 0 0
Goodsell F.M.T.401	£24 19 6
AMPLIFIERS	
Lowther	£60 0 0
Williamson (Goodsell)	£53 15 0
Leak	£40 10 0
Quad	£42 0 0
SPEAKERS	
Lowther T.P.1	£96 0 0
Wharfedale Speaker System	£72 0 0
Pamphonic "Victor"	£57 15 0
Acoustical Corner Ribbon	£96 0 0
Vitavox Klipshorn	£145 0 0
PICK-UPS	
Ferranti Ribbon	£36 6 8
Lowther Moving Coil Diamond Stylus	£12 13 3
Leak Moving Coil Diamond Stylus	£13 4 6

This is an extract from our comprehensive 16 page 2 colour Catalogue which is available 6d. post free) from:

CLASSIC ELECTRICAL CO LTD

352-364 LOWER ADDISCOMBE ROAD · CROYDON · SURREY TEL · ADDISCOMBE 6061-2

McMURDO



B7G and B9A VALVE RETAINERS

The McMurdo Valve Retainer secures the valve in the same manner as a screening can, but provides unrestricted ventilation for valve envelope. The retainer is clamped between the chassis and valveholder. It requires no additional fixing.

Retainers are supplied complete with Phosphor-bronze Springs.

Retainers may be used with our insulated Top Cap Connector Ref. No. TCI **(fits Valve Cap BS448 — Type CT1).**

For full details apply to :—

THE McMURDO INSTRUMENT COMPANY LIMITED
VICTORIA WORKS · ASHTEAD · SURREY
Tel. : ASHTEAD 3401

EDDYSTONE COMMUNICATION RECEIVERS
Now Available on attractive Hire Purchase Terms.

Model	Cash Price	Deposit	Monthly
740	£42 15 0	£8 11 0	£3 2 10
840	£45 0 0	£9 0 0	£3 6 0
750	£60 0 0	£13 12 0	£5 0 0
680	£106 0 0	£21 4 0	£7 15 6

Instalments are for 12 months.

The model illustrated is the 740. All are for AC only operation except the 840 which is AC/DC 110/250 v. making it especially suitable for universal use. Descriptive literature on request. The relaxation of H.P. restrictions enables us to offer the above attractive terms.

Latest Eddystone component catalogue 1/-

HP RADIO SERVICES LTD.,

The Eddystone Specialists

55 COUNTY ROAD, LIVERPOOL, 4
Telephone: AINTREE 1445 ESTAB. 1935
Branch Address MARKET CROSS, ORMSKIRK

LEEVERS RICH

HEAVY DUTY

MAGNETIC TAPE RECORDER

for Industrial and Professional Use

Frequency Range (±2db.), 30-18,000 c/s.
Volume Range 50 db.
Flutter <0.1%

MODEL C5
For spools up to 9ins dia., 12-volt battery operation

MODEL D1A
For all types of Spool up to 11¼ins. dia. A.C. operation

MODEL D2B
For all types of Spool up to 11¼ins. dia., 12-volt battery operation

Prices from £365 comp'ete

All of these models may also be supplied with

SYNCROPULSE (prov. pat.) INTERLOCK SYSTEM

LEEVERS-RICH EQUIPMENT Ltd.

Please note new address:
78, Hampstead Rd., London, N.W.1. EUSton 1481

AIR-DAMPED

ANTI-VIBRATION MOUNTS

of exceptional performance:

FOR THE PROTECTION OF AIRBORNE EQUIPMENT

- Superior vibration isolation.
- Improved shock absorption.
- Low permanent set and drift.
- Operation over wide temperature range
- Minimum side sway.
- Wide load range with uniform performance.

Air-damped BARRYMOUNTS have been specially developed to provide assured protection for sensitive equipment against shock and vibration. An outstanding feature is their remarkably uniform performance over the full range of rated load variation.

Over 1,000,000 BARRYMOUNTS go into use *every year* for the protection of every type of air-borne equipment, from the lightest and most delicate instruments and electronic devices to apparatus up to 140 lbs. weight.

There are also BARRYMOUNTS available for specialised vehicle-borne and ship-borne equipment applications.

Air-damped BARRYMOUNTS are supplied in a wide range of sizes for Rated Loads of from 0.1 to 35 lbs.

MINIATURIZED BARRYMOUNTS ARE USED IN THE BRISTOL "BRITANNIA"

SBAC

CB1

Made in England under licence from the Barry Corporation of U.S.A.

Write for technical bulletins.

CEMENTATION (MUFFELITE) LTD.,
39 VICTORIA ST., LONDON, S.W.1 (ABBey 5726)

BARRYMOUNTS

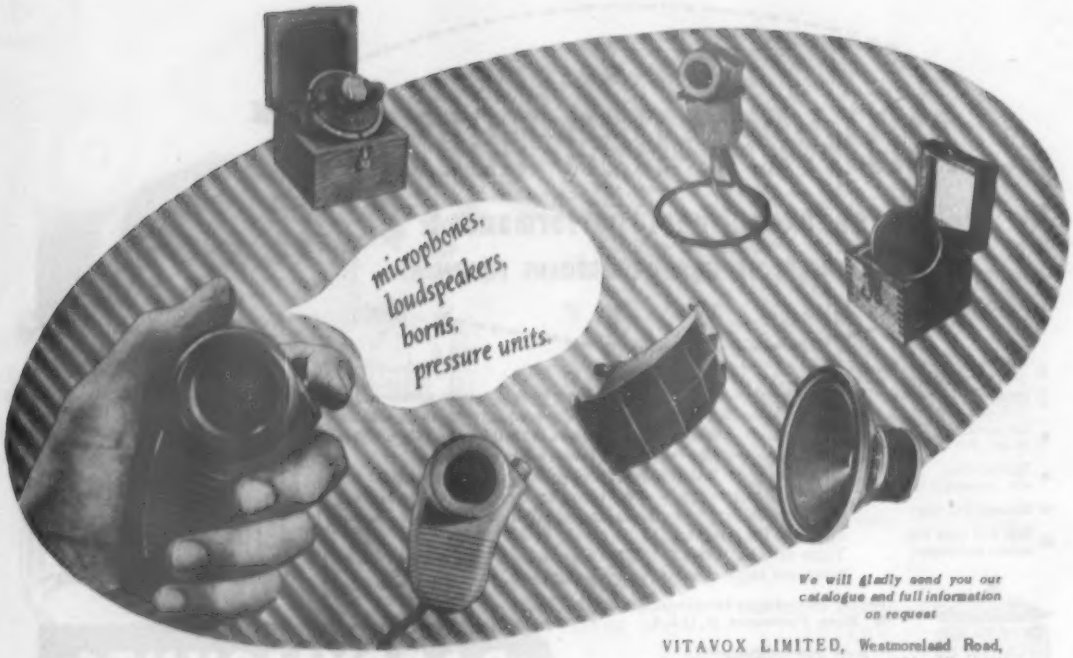
OSCILLOSCOPE MODEL 2300

This Model meets the need for a compact and robust instrument in which nothing has been sacrificed in order to achieve true portability. It has many of the facilities required in the laboratory as well as ruggedness demanded in the field. Note these features:

- Cathode Ray Tube diameter 2½in.
- Direct-coupled X and Y Amplifiers.
- Deflection Sensitivity 50 mV. R.M.S./cm.
- Frequency Response D.C. to 3 Mc/s.
- Square Wave Response adequate for Television synchronising waveforms.
- Hard-valve Time Base-range 7 c.p.s. to 50 Kc/s.
- Trace Expansion control from zero to 15in.
- Weight: 6½lbs. Size: 7¼ x 4¾ x 7¾in.

Full details of this and other instruments on application to:

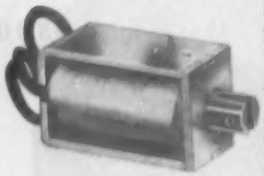
INDUSTRIAL ELECTRONICS MAGNET WORKS
DERBY ROAD, EAST SHEEN, LONDON, S.W.14. *Phone: PRO* 8211



We will gladly send you our catalogue and full information on request

VITAVOX LIMITED, Westmoreland Road, London, N. W. 9. Telephone: COLindale 8671

PHIL-TROL SOLENOIDS



Range covers types 41 and 42 (front 1" × 1¼") 38, 39, and 40 (front 1¼" × 1¾") and power A.C. and D.C. sizes up to 60 inch-lbs.

Most sizes available ex-stock and dispatched same day as receipt of order.

6 v.-460 v. A.C. and D.C. types

WRITE OR PHONE FOR DETAILS

PHILLIPS CONTROL (G.B.) LTD.

Farnborough, HANTS. *Telephone: Farnborough 1120*

London Office: 59/61 Union St., London, S.E.1. *Tel.: HOP 4567*

INSTRUMENT CASES

Sizes up to 17" x 10" x 9".
Send for list 32.

CHASSIS

Steel, cadmium plated and passivated.
Sizes from 6" x 6" up to 19½" x 10".
Send for list 42.

SUTTON COLDFIELD ELECTRICAL ENGINEERS

Clifton Street, Sutton Coldfield. Phone SUT. 5666

The NEW ACRU CELLOPHANE SEALING IRON

Gives the right heat in the right spot and makes perfect joints. Suitable for most plastics.

Ask for leaflet

THE ACRU ELECTRIC TOOL MFG. CO.,

CHAPEL STREET, LEVENSHULME, MANCHESTER, 19. *Tel.: Rusholme 4613*

THE

Armstrong A·10 HIGH FIDELITY ULTRA-LINEAR AMPLIFIER

Specialists in High Quality Reproduction for over 20 years

CONTROL UNIT Price: £9.15.0

AMPLIFIER Price: £19.15.0

CONTROLS: 1. Input: (a) Radio 50-100 millivolts. (b) Gram (low impedance) 15-100 m.v. (c) **Gram** (high impedance) 70-150 m.v. (d) Microphone or Tape Recorder 10-100 m.v. **2. Equaliser:** (a) 78'. (b) 78". (c) L.P. (d) American NARTB. **3. Filter:** (a) Roll-off 5kcs. (grad). (b) 7 kcs. (c) 9 kcs. (d) 9 kcs. (steep). (e) Level response. (f) Presence lift. **4. Treble:** Lift or cut of 15 db. **5. Bass:** Lift or cut of 15 db. **6. Volume Control:** combined with ON/OFF switch. **Power Supply:** For radio unit 300 v. 35 m.a. 6.3 v. 2 a. **Finish:** Hammered bronze with engraved Florentine bronzed panel.

The A.10 incorporates ALL NECESSARY FILTERS and no additional filter units are required. All components are fully tropicalised.

You can hear this outstanding Amplifier at your local High Fidelity Specialists or at our Showrooms at Holloway, which are open on weekdays from 9 a.m. to 6 p.m. (Saturdays until 5 p.m.). You are particularly invited to attend our special High Fidelity Demonstrations on Thursday evenings at 7 p.m. If you would like further particulars please write to us (Dept. W.F.) for descriptive booklet.

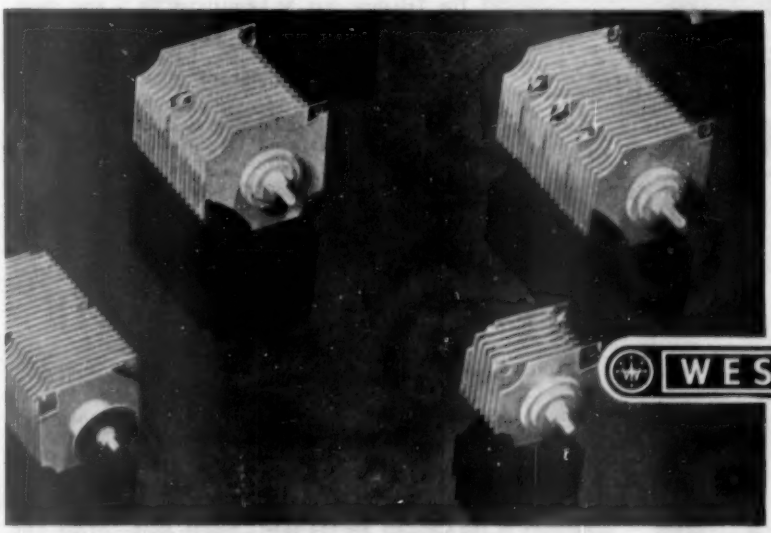
ARMSTRONG *WIRELESS & TELEVISION CO. LTD.*
WARLTERS RD., HOLLOWAY, LONDON N.7. Tel: NORth 3213/4

Output: 10-12 watts. **Distortion:** Less than 0.1% total harmonic at 8 watts. **Frequency Response:** 10-100,000 cps., within 1 db. 15-30,000 cps. **Hum Level:** Better than 80 db. down. **Damping:** Factor: 40. **Feed Back:** High degree of negative feed back giving outstanding transient performance (special Partridge output transformer with TERTIARY feed back-winding). **Input Required:** 250 millivolts for 10 watts output. **Mains Input:** 100-250 v. A.C. 40-60 cycles.

"RECORD NEWS" (November 1954) says:

"Its quality of reproduction is quite excellent, its power output more than adequate for all normal loudspeaker systems, its distortion infinitesimal and its frequency response leaves nothing to be desired. . . . It can only be praised and recommended without reservation."

Interested in F.M.? See page 50.



For Reliable Power Supplies

WESTALITE

METAL RECTIFIERS

Westinghouse metal rectifiers are still leading the field as the most efficient and reliable source of DC power for radio and television. The range of units available embraces all outputs from few to thousands of milliamps at any desired voltage, and those illustrated represent but a few of the many types in common use.

For further details on Metal Rectifiers, write to Dept. W.W.2.

WESTINGHOUSE BRAKE & SIGNAL CO. LTD., 82 YORK WAY, KING'S CROSS, LONDON, N.1

PREMIER RADIO CO.

B. H. MORRIS & CO. (RADIO) LTD. EST. 40 YRS.

(Dept. W.W.) 207 EDGWARE RD., LONDON, W.2. Tel.: AMBassador 4033 & PADdington 3271

THE COMPLETE TELEVISOR IS SAFE TO HANDLE, BEING COMPLETELY ISOLATED FROM THE MAINS BY A DOUBLE WOUND MAINS TRANSFORMER. ALL PRESET CONTROLS CAN BE ADJUSTED FROM THE FRONT, MAKING SETTING UP VERY SIMPLE.

The NEW
PREMIER TELEVISOR

SUITABLE FOR USE WITH THE ENGLISH ELECTRIC CATHODE RAY TUBE T901 OR ANY POPULAR WIDE ANGLE TUBE

Brief Technical Details are as follows:

20 valves (plus tube) Superhet Receiver, tunable from 40-68 Mc/s without coil or core changing. Wide Angle scanning Flyback EHT giving 14 kV. Duomag Focaliser, permanent magnet focusing with simple picture centring adjustments, suitable for any wide angle Tube, may also be used with a 12in. Tube with very minor modifications.

VISION CIRCUIT. Common RF Amplifier, single valve frequency changer, two IF stages, Video Detector and Noise Limiter followed by special type of Video Output Valve. ALL COILS PRE-TUNED ASSURING ACCURATE ALIGNMENT AND EXCELLENT BAND-WIDTH.

SOUND CIRCUIT. Coupling from anode of frequency changer, two IF stages, Double Diode Triode detector and first LF Amplifier, Diode Noise Limiter and Beam type Output Valve, feeding a 10in Speaker. ALL COILS PRE-TUNED.

TIME BASES. 2 valve sync. Separator, giving very firm lock and excellent interlace.

LINE TIME BASE. Blocking Oscillator using a pentode driving a high efficiency output stage comprising Ferroxcube Cored Output Transformer with Booster Diode.

FRAME TIME BASE. Blocking Oscillator driving a Beam Output Valve coupled through a Transformer to the high efficiency FERROX-CUBE Cored Scanning Coils.

POWER PACK. Double wound Mains Transformer supplying all L.T. and H.T. using two full-wave Rectifiers.

The Televisor may be constructed in 5 easy stages: **(1) Vision, (2) Time Base, (3) Sound, (4) Power Pack, (5) Final Assembly.** Each stage is fully covered in the Instruction Book, which includes layout, circuit diagrams and **point-to-point** wiring instructions.

The Instruction Book also includes full details for converting existing Premier Magnetic Televisors for use with modern wide angle tubes. All components are individually priced.

Instruction book 3/6, Post Free.

PREMIER TELEVISOR
CONSOLE CABINETS
For 14", 16" and 17" Televisors

A handsome Walnut Cabinet that will be a fitting housing for a first-class Televisor.

Folding doors are fitted to cover the Cathode Ray Tube when not in use. A flap is provided which gives access to the preset controls on the front edge of the Chassis. A baffle board suitable for a 10in. Loudspeaker and all the necessary Tube and Chassis bearers are included. The overall dimensions of the Cabinets are the same: Height 38½in. Width 19in. Depth Top 19in. Depth Bottom 21in.

TUBE ESCUTCHEONS

17in. White Moulded	21/- (pkg. & post 1/6)
17in. Bronze Moulded, complete with Protective Glass	42/- (pkg. & post 2/6)
14in. Black Moulded	7/6 (pkg. & post 1/-)
Dark Screen Filter suitable for 14in. Tube	21/- (pkg. & post 1/6)
Dark Screen Filter suitable for 16in. and 17in. Tubes	25/- (pkg. & post 1/6)
Polystyrene Mask for E.E.T.901	5/4 (pkg. & post 2/6)
Rubber Ring (anti-Corona) for E.E.T.901	6/8
Polystyrene Shroud for E.E.T.901	6/2

PRICE £13-10-0 PLUS 21/- PKG. & CAR. **H.P. TERMS: DEPOSIT £4.10.0 & 12 MONTHLY PAYMENTS OF 16/11**

TERMS OF BUSINESS: *Cash with order or C.O.D. over £1. Please add 1/- for Post Orders under 10/-, 1/6 under 40/-, unless otherwise stated.*

PREMIER RADIO COMPANY

Limited supplies of C.R. TUBES

VCR517C
6½in. picture. This tube is a replacement for the VCR97 and VCR517. Guaranteed full size picture.
Price 35/-. Plus 2/6 pkg., carr., ins

VCR516
9in. blue picture. Heater volts 4 anode 4 kV. In manufacturer's original carton. £1/19/6. plus 5/- pkg., carr. ins.

ALL BRAND NEW

CABINETS—PORTABLE

Model PC/1
Brown Rexine covered **22/6**
Overall dimensions 15 in. × 13½in. × 8in.
Clearance under lid when closed 2½in.

Model PC/2
Grey Linen Rexine covered **45/-**
Overall dimensions 15 in. × 12in. × 6in.
Clearance under lid when closed 2½in.

Model PC/3
Rexine type covering in various cols **60/6**
Overall dimensions 16½ in. × 14½in. × 10½in.
Clearance under lid when closed 4½in.
All the above Cabinets are supplied with Panel, Carrying Handle and Clips.
Packing and Postage 2/6.

5-WATT AMPLIFIER

Enclosed in metal case. Output suitable for 15 ohms and 3 ohms Speakers. Input switched for pickup or microphone. R.V.A. miniature valves. 9½ gns. Postage and packing 7/6.

E.A.R. MULLARD 510 AMPLIFIER

Based on the Mullard circuit. Combined change-over switch for standard, L.P. records and radio. Plug-in filter network. 18 gns. Postage and packing 7/6.

RECTIFIERS

	E.H.T. Fwsd.	Type S.T.C.	
Type K2/25	500 v.	1 mA.	4/7
,, K3/40	2.3 kV.	1 mA.	6/-
,, K3/45	3.6 kV.	1 mA.	6/9
,, K3/50	4 kV.	1 mA.	8/6
,, K6/100	8 kV	3 mA.	14/6
,, N2/160	12 kV.	1 mA.	21/6
,, K3/180	14.4 kV.	1 mA.	24/6
	H.T. Type S.T.C.		
Type RM1	125 v.	60 mA.	4/-
,, RM2	125 v.	120 mA.	4/6
,, RM3	125 v.	125 mA.	5/6
,, RM4	250 v.	250 mA.	15/-
	L.T. Type Full Wave		
6 v. 1 amp.			4/-
12 v. 1 amp.			6/-
12 v. 2 amp.			10/9
12 v. 4 amp.			15/-

BATTERY CHARGERS

200-250 v. A.C. Will charge 2 v., 6 v. and 12 v. Car Battery at 1 amp. Housed in strong metal casing. Finished in Green hammered enamel. Size 6in. long, 3½in. wide, 3½in. high. Guaranteed 12 mths. The above unit is manufactured by PREMIER and does not contain Ex-Govt. components. Plus 2/6 P. and P. **39/6**

BATTERY CHARGER KITS

All incorporate metal rectifiers. Transformers are suitable for 200-250 v A.C. cycle mains.
Cat. No.
2002 Charge 6 volt accumulator at 1 amp. Resistance, supplied to charge 2 volt Accumulator 13/6
2004 Charges 2, 6 and 12 v accumulator at 1 amp. 19/11

ALUMINIUM CHASSIS 18 s.w.g.

Substantially made from Bright Aluminium with four sides:

7 × 5½ × 2in.	4/-	10 × 9 × 3in.	7/-
7 × 5½ × 2in.	4/9	12 × 10 × 3in.	7/9
9½ × 4½ × 2in.	4/3	14 × 10 × 3in.	7/11
10 × 8 × 5½in.	5/6	16 × 10 × 3in.	8/3
13 × 9 × 2½in.	7/-	16 × 8 × 2½in.	8/-
14 × 9 × 2½in.	7/6		

ALUMINIUM PANELS 18 s.w.g.

7 × 6in.	1/3	7 × 4in.	1/-
9½ × 6in.	1/8	9½ × 4in.	1/5
10 × 9in.	2/2	10 × 7in.	1/11
12 × 9in.	2/9	12 × 7in.	2/3
14 × 9in.	3/2	14 × 7in.	2/11
16 × 9in.	3/6	16 × 7in.	3/5
20 × 9in.	4/8	20 × 7in.	4/5
22 × 9in.	5/2	22 × 7in.	4/11

SPECIAL OFFER!!

SAVAGE AUTO-TRANSFORMERS
INPUTS 110 v., 130 v., 200 v., 230 v., 250 v. Stud switch control. OUTPUTS 110 v and 230 v. at 1,200 w. nominal, tested 2.4 KVA. 15A. 3 pin sockets and fuses on panel in handsome grey cabinet. Brand new, £7/15/-. De Luxe model by Neverlin, £8/15/-. P. & P. 10/-.

A.C.R.I. C.R. TUBES

5in. screen. 4 volt Heater. This Electrostatic Tube is recommended as eminently suitable for Television. 15/- plus 2/6 Pkg., carr. and ins. Data sheets supplied.

GRAMOPHONE PRE-AMPLIFIER

Power requirements 200-250 v., 2 mA., and 6.3 v. .3a., this may be taken off existing radio.
All the components to build the above unit, 22/6, plus 1/6 pkg. and postage.

Famous Manufacturer's Surplus of

ANTI-INTERFERENCE AERIALS

offered at a fraction of original cost

The aerial is designed for reception of long, medium and short waves with any ordinary or communications receiver having an input impedance greater than 1,000 ohms long/medium waves and 150 ohms short waves. The installation discriminates against locally generated electrical interference, especially on the short wavebands. The equipment enables the installation of an 8.3 Mc/s Sally-tuned dipole which operates as a "T" aerial on medium and long waves. The aerial and receiver transformers are intended to be interconnected with a 70 ohms co-axial cable.

COMPONENT PARTS

Aluminium Aerial Transformer Assembly. Comprising one each: Aluminium transformer, Transformer clip rubber sucker, ¼in. × ¼in. brass screw, 4AB × ¼in. brass bolt, 4BA nut.
Receiver Transformer. Complete with insulators, clips, etc.; porcelain insulators 2 each, 60ft. insulated aerial wire, 60ft. screened co-axial down lead.
Installation instruction leaflet included.
LEAD CO-AXIAL CABLE & AERIAL WIRE. 15/- plus 1/6 pkg. and carr.
COMPLETE, 35/-, plus 1/6 pkg. and carr.

★ QUALITY CRYSTAL PICK-UP ROTHERMEL TYPE U48 26/-

Plus 1/6 Pkg. and Carr.

The New

"PREMIER PORTABLE"

TAPE RECORDER

USING THE NEW LANE 2 SPEED TAPE UNIT MARK 6

COMPLETE 39 GNS CASH

Packing & Carriage 1 gn.

(Including Reel of Scotch Boy Tape and Microphone)

or **Complete Kit** including All Parts, Valves, Speaker Cabinet, Tape Unit, Reel of Scotch Boy Tape, Rewind Spool and Microphone at **£37.4.0** plus pkg. & carr. 15/-.

H.P. TERMS

Deposit £10.4.9 and 12 monthly payments of £2.17.7

SPECIFICATION

- ★ TWO SPEEDS 7½in. AND 3¾in. PER SECOND.
- ★ THREE SPECIALLY DESIGNED RECORDING MOTORS.
- ★ 1,200ft. TAPE REELS PROVIDING PLAYING TIMES OF 1 HR. AND 2 HRS.
- ★ DROP IN TAPE LOADING.
- ★ EASY FORWARD OR REWIND WITHOUT REMOVING TAPE.
- ★ ONE KNOB DECK OPERATION.
- ★ 7 VALVE HIGH QUALITY AMPLIFIER.
- ★ INDEPENDENT TREBLE AND BASS CONTROLS.
- ★ MAGIC EYE RECORD LEVEL INDICATOR.
- ★ AMPLIFIER MAY BE USED FOR RECORD REPRODUCTION OF HIGH QUALITY.
- ★ COMPARTMENT FOR HOUSING MICROPHONE.
- ★ SPECIALLY DESIGNED MICROPHONE BY A LEADING MANUFACTURER.

SEPARATE UNITS CAN BE SUPPLIED AS LISTED BELOW:—

Amplifier (built, wired and tested with Speaker). £14/15/-, plus postage and carriage 7/6.
Hire purchase terms, Deposit £3/13/9 and 12 monthly payments of £1/0/9.
Amplifier Kit (including Speaker). £11/0 - plus packing and carriage 5/-.
Hire purchase terms, Deposit £2/15/- and 12 monthly payments of 15/6.
New Lane 2-speed Tape Unit Mark 6 £18/10/- plus packing and carriage 7/6.
Hire purchase terms, Deposit £4/12/6 and 12 monthly payments of £1/6/-.
Portable Cabinet (rexine covered). £4/19/6, plus postage and carriage 5/-.
Microphone, £2/15/-, plus postage and carriage 1/-.
Reel Scotch Boy Tape MC2-111 (1,200ft.) £1/15/-, plus packing and carriage 1/-.
Instruction Booklet. 2/6. Post free

PREMIER RADIO COMPANY

WILLIAMSON AMPLIFIER KIT 15 gns.
plus 7/6 p. & p.

H.P. Terms Dep. £5.5.0 & 12 m'thly p'ym'nts of 19/9

This Kit is absolutely complete and all components are guaranteed exactly to author's specification.

WILLIAMSON OUTPUT TRANSFORMER
Author's Specification 3.5 ohms secondaries **£4.4.0**

MAINS TRANSFORMER SP425A
(Completely Shrouded)

This Transformer has an additional 4.5 v. 3A and is capable of supplying an extra 50 mA. for Pre-amp or Feedback unit **£2.12.6**

WILLIAMSON CHOKES

10H. 150 mA. Fully shrouded **19/6**
20H 80mA. Fully shrouded **11/9**

METERS

Full Scale Deflection	External Dimensions in.	Movement	
3.5 A.	2½ × 2½	R.F. Thermo ..	7/6
20 A.	2½ round	M/C	8/6
40 A.	2½ round	M/C	8/6
5 mA.	2½ × 2½	.....	7/6
500 mA.	2½ round	M/C	10/6
30 A.	2½ × 2½	M/C	8/6
50 mA. ..	2½ × 2½	M/C	7/6
20 V.	2½ × 2½	M/C	6/6
40 V.	2½ × 2½	M/C	9/6
1 mA. ..	2 × 2	M/C	17/6
1 mA. ..	2½ round	M/C	22/6
1 mA. ..	2½ round	Desk type M/C	25/-

H.T. ELIMINATOR AND TRICKLE CHARGER KIT

All parts to construct an eliminator to give an output of 120 volts at 20 mA., and 2 volts to charge an accumulator. Uses metal rectifier, **17/6**.

PREMIER MAINS TRANSFORMERS

All primaries are tapped for 200-230-250 v. mains 40-100 cycles. All primaries are screened.

SP175B, 175-0-175, 50 mA., 4 v. @ 1 a., 4 v. @ 2-3 a. 15/-
SP350A, 350-0-350, 100 mA., 5 v. @ 2-3 a., 6.3 v. @ 2-3 a. 21/-
SP351A, 350-0-350, 150mA., 4 v. @ 2-3 a., 4 v. @ 3-4 a., 4 v. @ 1-2 a., 4 v. @ 1-2 a. 30/-
SP352, 320-0-350, 150 mA., 5 v. @ 2-3 a., 6.3 v. @ 2-3 a., 6.3 v. @ 2-3 a. 30/-
SP501A, 500-0-500, 150 mA., 5 v. @ 2-3 a., 6.3 v. @ 2-3 a., 6.3 v. @ 2-3 a. 40/-
SP425A, 425-0-425, 200 mA., 6.3 v. @ 2-3 a., 6.3 v. @ 2-3 a., 5 v. @ 2-3 a. 52/6
250-0-250, 30 mA., 6.3 v. @ 4 a., 5 v. @ 2 a. 19/6
350-0-350, 80 mA., 6.3 v. @ 4 a., 5 v. @ 2 a. 19/6
200-220-250 output 3 v.-30 v., @ 2 a. 17/6

E.H.T. TRANSFORMER, primary 210 v., 220 v., 230 v., secondary 4 Kv. and 2 v. **£3/7/6**
E.H.T. TRANSFORMER, primary 210 v., 220 v., 230 v., secondary 5Kv. and 2 v. **£3/12/6**

Build these NEW PREMIER DESIGNS

3-BAND SUPERHET RECEIVER

MAY BE BUILT FOR **£7.19.6** Plus 2/6 Pk. & Carr.

Latest type Superhet Circuit using 4 valves and metal rectifiers for operation on 200/250 volts A.C. mains. Waveband coverage—short 16-50 metres, medium 180-550 metres, and long 900-2000 metres. Valve line-up 6K8 freq. changer, 6K7, IF, 6Q7 Detector AVC and first AF, 6V6 output. The attractive cabinet to house the Receiver size 12in. long, 6½in. high, 5½in. deep can be supplied in either WALNUT or IVORY BAKELITE or WOOD. Instruction Book 1/- post free, which includes assembly and wiring diagrams, also a detailed stock list of priced components.

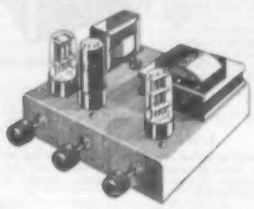
TRF RECEIVER

MAY BE BUILT FOR **£5.15.0** Plus 2/6 Pkg & Carr.

The circuit is the latest type TRF using 3 valves and Metal Rectifiers for operation on 200/250 A.C. mains. Wave band coverage is 180/550 metres on medium wave and 900/2,000 metres on long wave. The dial is illuminated and the Valve line-up is 6K7 H.F. Pentode 6J7 Detector and 6V6—Output. The attractive Cabinets to house the Receiver size 12in. long, 6½in. high, 5½in. deep, can be supplied in either WALNUT or IVORY BAKELITE or WOOD

INSTRUCTION BOOK 1/- (post free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

4-WATT AMPLIFIER



MAY BE BUILT FOR **£4.10.0** Plus 2/6 Pk. & Carr.

Valve line-up 6SL7, 6V6 and 5X4. FOR A.C. MAINS 200/230 VOLTS. The twin triode 6SL7 is used for preamplification and also for a comprehensive tone control circuit, which includes two very wide range and continuously variable tone controls for bass and treble. The output Valve is of the beam type and feeds 4 watts into a specially designed output Transformer which is suitable for either 3 ohm or 15 ohm Speakers. Negative feed-back is applied from the secondary of the output Transformer over the whole amplifier to the input stage giving an excellent frequency response. Due to the high gain and wide range tone controls any type of pick-up may be used. Overall size 9 × 7 × 5in. Price of Amplifier complete, tested and ready for use, £5/5/- plus 2/6 pkg. and carr.

INSTRUCTION BOOK, 1/- (Post Free) which includes Assembly and wiring diagram, also a detailed Stock List of priced components.

DECCA MODEL 33A
DUAL SPEED RECORD PLAYER

Includes crystal pick-up with sapphire stylus and a light-weight plastic sprung balanced arm. Heavy gauge pressed steel case with brown enamel finish in good quality for operation on A.C. mains 200/250 v. 50 c.p.s. Supplied complete with single lead (either standard or long playing). **£4.19.3**. Extra Head can be supplied. Plus pkg. and carr. 5/-.

B.S.R Type GU4A 3-SPEED GRAM UNIT

Fitted with Decca Heads

Single Record Player, 3-speeds 33⅓, 45 and 78 r.p.m. for operation on 105-120 volts or 200-250 volts A.C. Mains. Complete with one standard and one long playing head, crystal or magnetic (please state choice). **£7/19/6**. pp. & carr. 5/-. Suitable cabinet for above Player type PC/8 at 45/-. See advertisement on previous page.

MINIATURE TUNING CONDENSERS

2-gang .0005 mfd. with trimmers 6/9

PREMIER VARIABLE IMPEDANCE "MATCHMAKER" M.O.15 OUTPUT TRANSFORMER

Designed to meet the demand for an efficient variable ratio Output Transformer 11 ratios from 13 : 1 to 80 : 1 all centre tapped and can be used to match any output valves either single or push-pull Class "A" "AB1" "AB2" or "B" to any low impedance speech coil or combination thereof. Primary Inductance 50 henries 15 watts audio 100 mA. Price 45/-.

LOUDSPEAKERS

ELAC—5in. dia., Moving Coil, 15 ohms imp. .. 15/-
PLESSEY—5in. dia., Moving Coil, 3 ohms imp... 9/11
ELAC—8in. dia., Moving Coil, 3 ohms imp. .. 19/6
PLESSEY—8in. dia., Mains Energised, 3 ohms imp. (600 ohms field); with Pentode Transformer 22/6
PLESSEY—8in. dia., Mains Energised, 3 ohms imp. (600 ohms field) 19/6
PLESSEY—10in. dia. Moving Coil, 3 ohms imp... 23/6
GOODMANS—12in. dia., Moving Coil, 15 ohms. Plus 5/- packing and carriage £8/12/6
VITAVOX—K12/20 12in. dia., Moving Coil, 15 ohms. imp. £11/11
Plus 5/- packing and carriage.

CRYSTAL MICROPHONE INSERTS

Ideal for tape recording and amplifiers. No Matching transformer required, 3/6 post free.

ACCUMULATORS

2 volt 10 amp. (by famous maker) 4/11
2 volt 16 amp. 5/11

MOVING COIL METER

A super quality Moving Coil Meter basic movement 2 mA and 4 mA Scale dimensions 2¼in. Overall dimensions 2¼in. dia. 1¼in. deep. Bakelite Case projecting type. At present scaled 1 amp. R.F. By removing thermo couple, reversing scale and recalibrating the meter, a high grade test instrument with any range above the basic F.S.D. may be built up. Price 2 mA., 5/9, 4 mA., 4/9.

MICROPHONES

LUSTRAPHONE: Moving Coil, High Impedance, Stand Type **£5/15/6**—Hand Mike **£6/6/-**.
ROSETTE—Crystal Mike Incorp. the Filter Cell Insert. High Impd. Ball Type, **£2/10/-**.
CRYSTAL MICROPHONE—Rothermel 2ADS6. Especially recommended. **£2.15.0 Table stands for all the above 10/6 and 17/6.**
ACOS. High Impedance Crystal Microphone, type 36-1, 25/-.
ACOS. High Impedance Crystal Microphone, type 33-1 **£2/10/-**.
ACOS. "MIC 20" Impedance Crystal Microphone **£2/10/-**. (This Microphone can be used as either Hand or Desk type.)

CRYSTAL MICROPHONE

An entirely insulated crystal microphone which can be safely used on A.C./D.C. amplifiers High impedance. No background noise really natural tone. The ideal Mike for tape, wire and sound projectors, price **19/6**.

MAINS NOISE ELIMINATOR KIT

Two specially designed chokes with three smoothing condensers with circuit diagrams. Cuts out all mains noise. Can be assembled inside existing receiver. 4/11 plus 6d. pkg. and carr.

Germanium Crystal Diodes. G.E.C. wire ended, 2/6. 24/- doz.

PREMIER RADIO COMPANY

1155 RECEIVER UNIT

In original cases complete with 10 valves. Frequency range 18.5 Mc/s.-75 Kc/s. in 5 wavebands. **£11/19/6.** Plus 10/6 packing and carriage.
Hire Purchase Terms: £2/19/11 Deposit and 12 monthly payments of **14/10.**

POWER SUPPLY UNIT

for above, incorporating output stage. Supplies an output of 250 volts at 80 mA. which is ample for the R1155 with the output stage. Jones plugs for connecting the Power Pack to the Receiver are included. The 6V6 output stage complete with Output Transformer and 6in speaker is built into the unit. Price **£5/5/-**, plus 5/- packing and carriage. The two above Units together on Hire Purchase Terms: **£4/6/2** Deposit and 12 monthly payments of **£1/4/2.**

PUSH-PULL OUTPUT TRANSFORMERS. 2 x 6V6 into 2/3 ohms., **5/6**, post free.

T.1154. BRAND NEW COMPLETE WITH VALVES, **£3/19/6**, post and carriage 7/6.

METER RECTIFIERS. Miniature type with leads 1-0 mA., **6/9**, post paid.

AMPLIFIER TYPE A1134A. Battery operated 9 valves, type VR.21 and VR.35, **9/11**, postage and carriage 1/6.

SLIDER RESISTANCE. Geared adjustment, 7.5 ohms, 4 a., **12/6**, postage and carriage 1/6.

HEAVY DUTY POWER RESISTANCE. 17.5 ohms, 8 a. with adjustable tapping 19in. long, 2¼in. diameter, **10/-** postage and carriage 2/-.

HEAVY DUTY L.T. TRANSFORMER. Primary tapped 180-230 volts, 50 cycles. Secondaries 4.2 v. 10 a. 4.2 v. 10 a., **25/-**, postage and carriage 2/6.

ROTARY RESISTANCE. Wire wound heavy duty 14 k. ohms, **7/6**, postage and carriage 1/-.

VACUUM PUMPS. For model makers etc. Ex-R.A.F. Type RS-Mk. III, **22/6** postage and carriage 2/-.

SPECIAL OFFER

5-VALVE SUPERHET RADIO RECEIVER

PRICE

£10.19.6

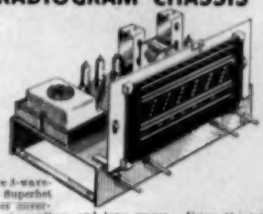
Pkg. & Car. 10/-

In highly polished walnut cabinet. Built to high standards ensuring quality reception. Specification:

VALVE LINE-UP: 7S7, 7B7, 7C6, 7C5, 7Y4, 3 WAVEBANDS, Long, Medium and Short. CONTROLS Tuning, wave change, volume tone control on/off Gram Position on Switch. Pick-up and Extension Speaker Sockets incorporated. For use on 200/250 v. A.C. mains. DIMENSIONS: Width, 14¼in. Height 13¼in., depth 8¼in.

H.P. Terms: **£3/14/11** deposit, and 12 monthly payments of **15/6.**

RADIOGRAM CHASSIS



5 Valve 3-waveband Superhet Receiver covering short, medium and long waves. Using the latest miniature all glass valves, overall chassis size 13½in. x 7in. high x 6in. deep, dial aperture 10in. x 4¼in. BRAND NEW, READY FOR USE AND GUARANTEED. **£10-5-0**
Packing and postage 10/-.
Or on Hire Purchase Terms, deposit **£2/11/3** and 12 monthly payments of **14/5.**

CABINET available for above Chassis in figured walnut, lined with white sycamore, size 21in. wide, 21in. high, 11in. deep, **£15/15/-.**
Or on Hire Purchase terms, deposit **£3/18/9** and 12 monthly payments of **£1/3/3.**
Packing and Carriage extra.

COMPONENTS AVAILABLE FOR THE MULLARD AND OSRAM DESIGNS

FREQUENCY MODULATION

All components for the Denco F.M. Unit, less Valves **£4-16-1**
Packing and postage 1/6.

GARRARD 5S UNIT

Garrard rim drive 78 r.p.m. complete with magnetic pickup and turntable. Postage and packing 2/6. **£4-19-6**

All components supplied for our Radio and T.V Designs are guaranteed for a period of 12 months (Valves carry the usual Maker's 3 months' guarantee).

Send 2½d stamp for our 1955 Catalogue

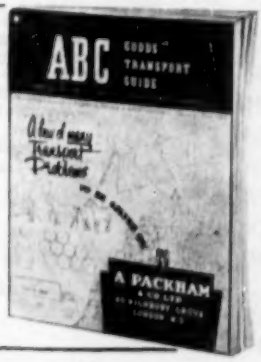
Transport Managers

Despatch Managers

and Consignors

— to send anything anywhere, consult the

ABC
GOODS TRANSPORT GUIDE



You will find this new and enlarged edition of the GOODS GUIDE an invaluable aid in your work. With its help you can speedily find the nearest and quickest means of despatching loads of all sizes and kinds.

"Smalls" or bulk, local or long distance, you will have the information required for moving *your* goods at your finger tips, with this essential book. Jan.-June issue ready NOW.

Half-yearly issues: Jan.-June 1955 and July-Dec. 1955.

3s. 6d. each POST FREE

ORDER FORM

To: Iliffe & Sons, Ltd., Dorset House, Stamford St., London, S.E.1.
Please send me *Jan.-June 1955 and July-Dec. 1955 issues of ABC Goods Transport Guide when published. I enclose remittance for *7s./3s. 6d.

*Delete where necessary if only one issue required.

Name.....

Address.....

..... W.W.

STREAMLINED PRODUCTION
means high quality at low cost

A Monarch Automatic Record Changer is produced every 15 seconds throughout each day. This outstanding production achievement, which will be bettered in the very near future, is the first fruit of an extensive re-equipment programme recently laid down by B.S.R. Here the finest precision machinery, the most modern production methods and raw materials and labour of the highest standard are integrated to produce the world's finest autochanger. Here rigid stage by stage quality and accuracy control, and rigorous final testing determine the reliability and superlative performance the listener has come to expect of the Monarch. *B.S.R. are today the world's largest producers of autochangers and players outside the U.S.A.*

MONARCH
AUTOMATIC RECORD CHANGER

BSR

BIRMINGHAM SOUND REPRODUCERS LIMITED, OLD HILL, STAFFS

Wireless World

RADIO, TELEVISION, ELECTRONICS

Managing Editor:
HUGH S. POCOCK, M.I.E.E

Editor:
H. F. SMITH.

FEBRUARY 1955

In This Issue

Editorial Comment 51
Television Society's Exhibition 52
Television Standards Conversion. *By H. A. Fairhurst* .. 53
Monte Carlo Television Station. *By Charles B. Bovill* .. 55
World of Wireless 56
Introduction to Transistor Electronics—1. *By H. K. Milward* 60
Historic Valve Collection 65
Ionosphere Review, 1954. *By T. W. Bennington* 66
Simple Wave-Shaper. *By Arthur W. Wayne* 69
Letters to the Editor 71
Vector Addition and the Slide Rule. *By A. G. London* .. 73
Flux-Cutting or Flux-Linking? *By "Cathode Ray"* 74
Measurement of Rise-Time. *By E. G. Dann* 79
Workshop R-C Bridge. *By B. T. Gilling* 80
Books Received 82
"Piped" Scanning Waveforms. *By E. J. Gargini* 83
Lacquer Film Capacitors 87
Recording Topics. *By O. J. Russell* 88
Gramophone and Microphone Pre-Amplifier—2. *By P. J. Baxandall* 91
Short-Wave Conditions 94
Simple Inductance, Capacitance and Resonance Meter. *By L. F. Sinfield* 95
Magnetic Induction Headphones 96
February Meetings 97
Random Radiations. *By "Diallist"* 98
Unbiased. *By "Free Grid"* 100

VOLUME 61 NO. 2
PRICE: TWO SHILLINGS

FORTY-FOURTH YEAR
OF PUBLICATION

PUBLISHED MONTHLY (4th Tuesday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. *Telephone:* Waterloo 3333 (60 lines). *Telegrams:* "Ethaworld, Sedist, London." *Annual Subscription:* Home and Overseas, £1 7s. 0d. U.S.A. $4.50. Canada $4.00. BRANCH OFFICES: *Birmingham:* King Edward House, New Street, 2. *Coventry:* 8-10, Corporation Street. *Glasgow:* 26a, Renfield Street, C.2. *Manchester:* 260, Deansgate, 3.

VALVES, TUBES & CIRCUITS

26. Additional Applications of the PCF80

The Mullard PCF80 was designed primarily as an additive mixer for front end stages in Band I and Band III television receivers and converters in association with the PCC84. This application has been discussed in *Valves, Tubes, and Circuits* Nos. 15, 16, and 17 (available as reprints with additional notes). The low interelectrode capacitances and short grid base of the valve make it suitable for a number of other applications in which the EF80, ECL80, ECC82, and other valves have hitherto been used.

In television receivers the triode and pentode section of one PCF80 can, with certain limitations, be used to perform separate functions. The performances of the two sections in various audio and video circuits are briefly discussed below. A chart, indicating the permissibility of a large number of combinations of function, will be included in the reprint of this advertisement.

When the triode and pentode of the PCF80 are to be used in different circuits in a television receiver, the advisability of a particular combination is determined by the internal coupling between the sections, especially if the signal levels are widely different, or if the pentode is to be the first valve of a high gain cascade circuit. Use in such a cascade circuit is inadvisable unless the total gain of the stage, or the source impedance, is very low. With a low source impedance, moreover, hum becomes a limiting factor.

The internal coupling has two components: the cross capacitances, and the leakage paths across them. The leakage paths are negligible in all but the most critical combinations of function. The most important capacitive coupling is that between the anode of the triode and the first grid of the pentode. Its maximum value is 0.16pF plus the valveholder capacitance of 0.15 to 0.4pF. The capacitances from the pentode to the triode grid are less than 0.02pF.

The use of the triode in audio applications is restricted by the leakage paths, which will make operation impossible at low audio levels when the pentode is used in a video or timebase circuit. Conversely, the combined effect of the cross capacitances and their shunt resistances prevents the use of the pentode as an audio valve when the triode is used in a video or timebase circuit. The power output of a single triode or even of two in push-pull is insufficient for use in the audio output stage.

With the pentode as a sound or vision i.f. amplifier, the triode may be operated in timebase, video i.f., or audio circuits. It is necessary to minimise hum by effectively earthing the pentode grid or at least by providing the lowest possible impedance to earth. The impedance should not exceed 40kΩ at low frequencies, and it should be still less at higher frequencies. Capacitive decoupling of the earthy end of the i.f. coil is obtained with 0.1μF min. for a 50 c/s interfering signal and 0.001μF min. for 10 kc/s. The most stringent of the combinations in this respect is with the pentode as sound i.f. amplifier and the triode as a timebase or video valve.

The pentode may be used as a video amplifier in place of the EF80 with a slightly reduced gain but a greater peak-to-peak output; or as a synchronising pulse separator with a low screen grid voltage and a high value of anode load to obtain a very short grid base. The triode may be used as a frame pulse clipper or as a conventional frame blocking oscillator.

Both sections may be used in a multivibrator circuit to produce a line scanning waveform. A resonant circuit in the triode anode circuit can help to stabilise the natural frequency of the oscillator, if it is locked by a flywheel synchronising system. This can be achieved by returning the control grid of the pentode to a source of controlling bias. In this application no interference is seen if either section of the valve is used for synchronising pulse separation or clipping. But with the pentode in this multivibrator circuit and the triode acting as a frame timebase blocking oscillator, some interaction between line and frame scanning occurs. This combination is not recommended.

In fringe areas, 405-line operation under noisy conditions is considerably improved by flywheel synchronisation. The line timebase coincidence detector which is necessary can incorporate the PCF80 pentode with the two coincident pulses applied to the control and screen grids. The triode can then act as the separate pulse amplifier. In this application the triode or the pentode may be transferred to any of the other scanning applications already discussed without undesirable stray coupling effects.

Circuits for the recommended applications will be published in a future advertisement in this series.

Reprints of this advertisement, with additional notes consisting of a comprehensive application chart, are available without charge from the address below.

Mullard

MULLARD LTD., Technical Service Department, Century House, Shaftesbury Avenue, W.C.2

MVM 313

Wireless World

FEBRUARY 1955 VOL. 61 No. 2

As She Is Spoke

EVER since wireless telegraphy became practicable, the tongue that Shakespeare spoke has proved short of words for the clear expression of ideas connected with the new method of communication. True, the long-forgotten journalist who wrote, at the turn of the century, about "the message being flashed" was inspired. That phrase, though never quite to the taste of the professional, conveyed to the layman (at least in the days of spark transmitters) a vivid and not inaccurate impression of what really happened. But, after 50 years or more, messages are still being flashed, and the public seems sadly in need of a new phrase.

Of course, it was not until broadcasting came that radio made a big impact on the public at large. We then had an unrivalled opportunity to start off on the right foot. The word "broadcasting" itself was a first-rate example of figurative English, derived in accordance with the best tradition. It is with shame that we admit ignorance of the true paternity of this heaven-sent word. Was it of American origin? Anyway, "broadcasting" was at once adopted by the professional, but, with a queer lack of good taste, the man in the street showed a strange preference for "the wireless" and later for "the radio."

Each new development brought its own inept phraseology. Television was no sooner established than the expression "radio and television" began to trip off the lay tongue (and sometimes, alas, the professional one as well). A nice puzzle it must make for a foreign visitor with a mainly academic knowledge of English, who may reasonably guess that our television is transmitted pneumatically! We were not surprised to see the other day the headline "British Radio and V.H.F." in a lay journal.

The latest innovation in sound reproduction—ready-recorded magnetic tapes—might easily become the next victim of our genius for choosing the confusing name. They have been referred to as "pre-recorded tapes," which might mean virgin tapes, and "tape recordings," which might mean anything. Fortunately, there is some hope here that a reasonably clear and descriptive name will prevail. E.M.I., the pioneers of these new rivals to disc records, assure us they are to be known as "tape records."

The B.B.C. has not, we fear, proved itself a zealous guardian of the language of its own medium of communication. Some time ago a correspondent drew attention in our columns to the absurdity of that favourite B.B.C. expression "pre-recorded" by enquiring about the meaning of "post-recorded." We believe there is some subtle significance in such variants as "the programme was recorded," "pre-recorded" and "from a recording," but nobody seems to know the code. Then there is the most abominable of all B.B.C. words "tele-recording" which seems utterly unnecessary in any imaginable context. Why "tele-," when, in most cases, distance is not an essential factor? Unless the Corporation mends its ways, abominations like "the telly" will soon become respectable and accepted.

Anarchy in the Ether

RECENT newspaper stories about experimental transmissions from the so-called "Europe No. 1" station on the Felsberg make sad reading, and serve to emphasize the chaotic state of congestion on the medium and long-wave broadcasting bands. The station has been transmitting test signals on various frequencies between 238 and 255 kc/s. Naturally enough, as all the channels in that band are already occupied, severe interference has been caused, and protests have been made by the authorities concerned. The Saar has no allocation in the long-wave band, and so it is difficult to see any excuse for these attempts on the part of the station to find a niche for itself.

The Copenhagen Plan is almost a dead letter. For example, under it the two German Republics and Austria are allowed between them 15 medium-wave stations, but have actually 65, plus 37 stations run by the occupying Powers. Clearly, the only solution lies in drastic reduction of the number of medium-wave stations, with supplementary reinforcing services on v.h.f. To evolve a new plan on this basis must be the first task as soon as the international climate is favourable for a conference.

Television Society's Exhibition

AN annual event of importance to television enthusiasts, the Television Society's Exhibition, was held this year on January 6th-8th. Marconi's had a camera chain in operation, which provided shots of the exhibition itself, and Belling-Lee arranged the distribution of the signal and also of the B.B.C. programme to exhibitors demonstrating apparatus. Belling-Lee also had a demonstration of the effects of interference suppressors in television reception in Bands I and III. Under the conditions of test a Band I suppressor in the leads to a small motor proved very effective in eliminating interference on Band I, but was quite ineffective on Band III. It was shown that to obtain suppression here a special suppressor had to be mounted inside the motor frame close to the brushes. Dubilier showed inductors and capacitors for suppression, the inductors being miniature dust-core types which it is recommended should be connected in series with the motor field windings close to the brushes.

The effect of the form of modulation upon ignition interference was demonstrated by the G.E.C. A signal with positive or negative modulation was fed, with interference, to a receiver which could be appropriately switched to deal with either type of modulation. The superiority of positive modulation was most evident. Although the black spots of interference with negative modulation were in themselves less evident than the white spots with positive modulation, the synchronizing was so greatly affected that the picture was useless, whereas with positive modulation the synchronizing was hardly affected at all.

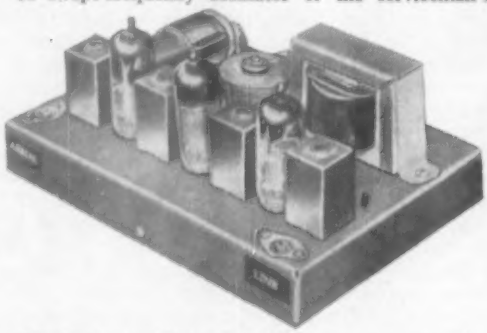
Interference is, of course, a matter of major importance in fringe areas, and a scheme which may well reduce it and also permit a useful signal to be obtained in screened locations was shown by J. S. Fielden. This is a three-valve pre-amplifier designed for mounting on an aerial pole and powered by a 50-c/s supply which can be fed to it through the same coaxial cable that is used for the signal. It is intended for use where it is possible to take advantage of neighbouring high ground to erect an effective aerial, perhaps at some distance from the receiver. The repeater 2000/S5 has a bandwidth of 10 Mc/s and can be used with solid-dielectric coaxial cable at distances up to 500 yards or with semi-air spaced cable up to 1,000 yards. It operates on Band I. For Band III a convertor unit will be available which will be pre-set to change the frequency of the Band III signal to a Band I channel adjacent to the normal Band I signal, so that the repeater will handle both signals.

Another kind of repeater, intended as a line amplifier for a television relay system, was shown by G.E.C. The interesting thing about this was the use of transistors instead of valves. The advantages of transistors for this type of application are, of course, their small size, robustness and need for only one supply of low-voltage power. The amplifier actually uses experimental point types, and it works at a centre frequency of 5 Mc/s with a bandwidth of 3 Mc/s. A gain of 32 db is obtained and the frequency response is flat to within ± 0.5 db over the 3-Mc/s band.

Test apparatus naturally formed a large section of the exhibition, and of particular interest was the equipment developed by Bush Radio for the testing and alignment of television sets in production. The heart of the instrument is a swept-frequency oscillator covering about 33–39 Mc/s for i.f. alignment using a cathode-ray display. Spot frequencies are also available for sound-channel rejector adjustment and checking.

The i.f. sweep can be heterodyned to the video range and the resulting video sweep used to modulate r.f. carriers in Bands I and III. Complete television signals, both sound and vision, are provided on three channels in each band, and the vision signal is modulated in alternate "lines" by the video sweep and by a 5-μsec pulse. The receiver output is displayed on a double time-base tube to show the overall video response and the pulse response. Final alignment and adjustment can then be carried out in an overall test. The outputs are "piped" around the factory to the test positions.

A swept-frequency oscillator of the serviceman's



Television pre-amplifier by J. S. Fielden; for a remote aerial.

Band III convertor (below) for the type 1320 Cossor Telecheck swept-frequency oscillator (above).

type was shown by Cossor. This is the 1322 Telecheck which covers Bands I and III and gives a 10-Mc/s sweep on its fundamental and proportionally more on its harmonics. The fundamental range is 10–22 Mc/s. A crystal-controlled marker generator is included. A Band III convertor, model 1321, for the older 1320 Telecheck, which covered Band I only, was shown. It is arranged to screw on to the 1320 instrument.

Amongst an interesting selection of American test gear shown by Livingston Laboratories was an oscilloscope designed for maintenance and adjustment of television transmitter and studio equipment—the Tektronix type 524-D. It can be used for observing the waveforms of complete television frames or single lines or portions of lines. The Y amplifier has a maximum frequency of 10 Mc/s and is flat to 5 Mc/s, while the timebase rate is continuously variable from 0.01 sec per centimetre to 0.1 μsec per centimetre. Special features include variable sweep delay, sweep expansion (for magnifying detail), an amplitude calibrator and time markers at intervals of 1 μsec, 0.1 μsec and 0.05 μsec.

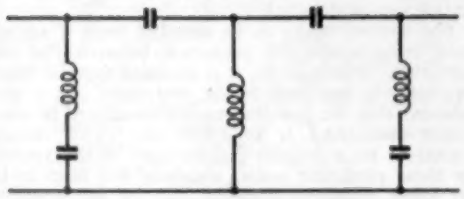
Radio-Aids showed a small three-stage i.f. amplifier feeding a crystal detector and microammeter. It is available pre-tuned to any Band I channel and calibrated to measure signal inputs up to 1 mV. It is intended for use in aerial and feeder testing and, with a known aerial, for determining the field strength so that a dealer may decide beforehand what sort of aerial it will be necessary to erect.

Apparatus for the measurement of oscillator drift on Band III was shown by Ferguson. A crystal-controlled signal is fed into the receiver under test and the i.f. output is mixed with another crystal-controlled oscillator. The initial adjustment is to zero beat. Oscillator drift then causes the beat frequency to rise and this is recorded by a Servograph.

Printed-circuit technique is developing rapidly and T.C.C. showed many examples. One of considerable importance for the future was the basis of a Band III tuner and well showed the advantage of the technique in securing uniformity of lead length in production. Another example was an aerial filter, intended for receivers using a 34.65 Mc/s i.f., to prevent i.f. breakthrough. With the circuit of Fig. 1, the coils and capacitors are all printed. The insertion loss is 2 db and at all frequencies below about 41 Mc/s the insertion loss is never less than 20 db and reaches a maximum of 34 db at 38 Mc/s.

There was very little evidence of work on colour television except in the field of cathode-ray tubes. 20th Century Electronics had modified one of their four-gun oscilloscope tubes so that the screen was divided into four quarters, one having an ordinary white phosphor and the others having red, green and blue phosphors respectively. The four electron guns were arranged in a corresponding pattern, with one directed on each phosphor, so that it was possible to display white, red, green and blue television pictures simultaneously. Each gun had its own electrostatic deflection plates and these were fed from the common scanning generators through blocking capacitors so that individual shift voltages could be applied. It was also possible to control the brightness and contrast of each picture separately.

On the Mullard stand were some 14-inch experimental c.r. tubes with coloured phosphors, intended for use in colour-picture monitors of the type in which the three coloured images are combined optically by dichroic or half-silvered mirrors. The tubes, which



T.C.C. printed "i.f. breakthrough" filter.

are electrically identical and operate with 12 kV on the final anode, are the types 36CDD12-3, -4 and -5, having blue, green and red phosphors respectively. Another new experimental tube shown by Mullard was the 4MK13 flying-spot scanner, intended for use at the transmitting end for scanning coloured slides and films. To obtain the necessary high level of brightness the anode of the triode gun operates at 25 kV, while the 5-inch screen is claimed to give a substantially panchromatic light output.

Various colour phosphors were demonstrated in Ferranti cathode-ray tubes by the chemical manufacturers Derby & Co., and here the difficulty of producing a good red-emitting phosphor was very evident. Most of the colour television demonstrations so far have, in fact, given rather poor colour rendering in this particular component.

TELEVISION STANDARDS CONVERSION

Possibility of Direct Electronic Method

By H. A. FAIRHURST*

STANDARDS conversion in television is by no means new, but it is probably not common knowledge that there is a possible alternative to the "brute force" method (of a camera viewing a c.r.t. monitor) used during the "Eurovision" programme exchanges. Whether this alternative could be developed into a system capable of giving acceptable results is not known, but it has a sound theoretical basis and has been proved to work on the bench.

The fundamental principle of the alternative system is that selected lines of picture information at the higher definition are stretched in time until each occupies the line duration of the lower definition system. This is performed by feeding the selected picture line into a delay line of sufficient delay to accommodate the whole slice of information at once, and then switching the characteristics of the delay line while the information is still all inside the line so that when it does emerge it does so at the new desired rate.

Because the higher definition lines occur at a greater rate than those at the lower definition, some of them must be sacrificed, but from the point of view of the lower definition user he will not miss what he has never had, and as the system is theoretically capable

* Murphy Radio.

of giving full horizontal definition his picture should be fully up to standard.

The system works in its simplest form if certain fixed relationships are preserved between the two standards. For example, it is assumed that the frame frequency is the same in the two cases. It is also assumed that the line frequencies are related in some simple manner—2:1, 3:2, 5:3, etc. This can be argued to be a definite disadvantage of the system, for these particular ratios, assuming 405 lines to be the lower definition standard, call for 405 lines, 50 frames, sequentially scanned, 607½ lines interlaced, and 675 lines interlaced, respectively, in the corresponding higher definition systems.

A 405-line non-interlaced system is a case by itself and will not be further considered here, while 607½- and 675-line systems do not appear anywhere as accepted standards. However, of these three, it can be shown that only the 675-line system is an acceptable higher definition to be linked by electronic standards conversion to 405 lines, and this because of the desirability of preserving the interlaced scan.

For the purposes of illustration, the 675-405 line case is shown in Fig. 1, which indicates the sequence of lines chosen from the higher definition (numbered) to make the consecutive lines at the lower definition (broken lines). Three delay lines are required to handle the information without overlap, and the form and timing of the delay line switching pulses are shown. Owing to the need to use three only out of every five high-definition lines, and to the consecutive nature of the lower definition lines, there will be a regular

Fig. 1. Showing how the high-definition lines (numbered) are selected and distributed in sequence to the three delay lines, where they are stretched in time to produce the lower-definition lines (broken lines) which follow continuously upon each other. The waveform of the delay-changing current is shown for each delay line.

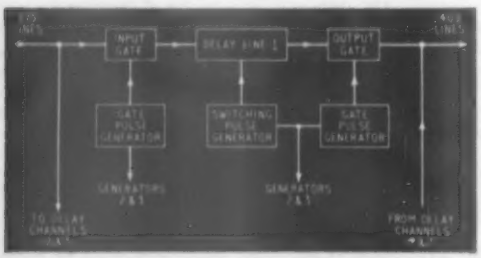


Fig. 2. Simplified block diagram of one of the delay channels. The input gating generators are controlled by the 675-line sync pulses and the output gates from a 5 : 3 count-down circuit operated by these pulses.

slight deformation of the picture in a vertical direction, but this can be shown to be a fixed pattern and normally invisible.

As three delay lines are required to handle the conversion, it is necessary to provide switching and gating circuits to switch the desired picture lines into the correct sections and also to sample the three outputs in turn so as to combine them into the lower definition signal. At the same time means must be provided for switching the constants of the delay lines at the correct times and for the correct durations. Fig. 2 is a simplified block diagram of one of the delay channels.

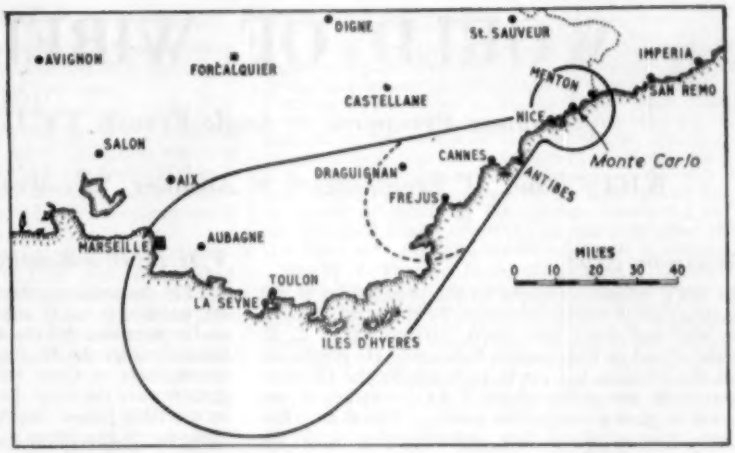
What of the delay lines themselves? The criterion here is that their constants must be capable of being switched to change the velocity of propagation through them. This could be done by winding the elements of the line on closed ferrite cores which can be saturated magnetically by current flowing through an additional winding. One arrangement successfully tried was to wind each element of the delay line as a toroid on a small ferrite ring and then to string them all on to a copper rod through which was passed the saturating current. Such a coil wound on a grade of ferrite suitable for the frequencies involved has its inductance reduced to nearly one-sixth when the core is saturated, so the smaller change required for the conversion process is easily obtained with quite practicable saturating currents.

Further removed, perhaps, from the bounds of possibility is the number of elements required in each line to obtain the requisite delay. It will obviously be a large number, and will depend a lot on the phase characteristic that can be maintained, but if a cut-off frequency of 20 Mc/s be assumed, with the values of $L=25\mu H$ and $C=10$ pF the number works out to be over 6,000. This would present a pretty problem for the designer, but it is no doubt not insoluble.

Fig. 2 is very much simplified and gives little hint of the complexity of circuitry which may be involved. It does not indicate, for example, that means must be provided for obtaining an exact timing of the outcoming information and for matching the outputs of the three delay lines. Fortunately the time intervals allow the saturating current pulse to be shifted a few microseconds either way, and this facility could provide a micrometer adjustment on the time the information spends in the line and, therefore, of the instant it begins to emerge. Control of the duration of the outcoming line of information can be achieved by varying the actual amplitude of the saturating current pulse. In this connection it must be noted that the saturating current must have a d.c. component in order to prevent any tendency to saturate the cores in both directions.

Bench experiments with short sections of line have demonstrated the stretching of a pulse and also the various other effects that would be expected on theoretical grounds when the constants of a line carrying a signal are switched. These experiments have shown that to develop such a standards convertor would be a major undertaking, but they have not shown it to be impracticable.

A system of conversion such as this offers one kind of solution to the problem of compatibility in colour television. It would make possible, for example, the transmission on 405 lines of monochrome versions of colour pictures which were being put out on some higher definition system—or, indeed, the transmission of coloured 405-line versions of these higher definition colour pictures.



Estimated polar diagram for the transmitter when it is on full power. The dotted line shows the present estimated coverage.

By

CHARLES B. BOVILL

A.M.I.E.E., M.Brit.I.R.E.

MONTE CARLO TELEVISION STATION

WITH several different standards being used for television in Europe, it was inevitable that eventually the problem of a transmitter located on a "standards frontier" should arise, and it is therefore of interest to examine what has been done in the case of the Monte Carlo television station which was recently put into service.

This station, which is the second commercial television station to be opened in Europe (the other is in the Saar), is situated on Mont Agel, a 3,500-ft mountain overlooking the Principality of Monaco and only some 10 miles from the Franco-Italian frontier.

Since the station is sponsored commercially, and the sponsors are French and handling the publicity for French merchandise, the role of the station is to serve the thickly populated area lying between Menton to the east and Toulon and Marseille to the south west. As Italian television standards differ from the French 819-line system the transmissions would not normally be receivable in Italy. Special receivers will soon be available for this area, however, so that programmes intended for Italian viewers will also be possible.

The design of the station therefore called for the maximum cover towards the south east, and adequate cover for the Principality and French towns extending to the Italian frontier. It will also be appreciated that there is no requirement for any cover over the sea over an arc of about 150 degrees to the south east and south west, nor for cover over the almost uninhabited Alpine region to the north.

The rather special cover requirements have enabled the designers and manufacturers of the station, the Société Radio Industrie, to construct a most economical and effective installation by the use of directional high-gain aerials. The aerials, which are of batwing type, provide a main lobe with a horizontal width of about 45 degrees which provides the main Riviera cover towards Nice, Cannes and Toulon. Very small secondary or side lobes—usually a serious problem to eliminate in directional aerial design—provide, with slight modification to the aerial array, the necessary cover for the nearby towns towards Italy. The aerial arrangement incorporates radiators for video and for sound, each having a power gain of about 10, the effective radiation on the video frequency of 199.7 Mc/s being 50 kW and on sound 12.5 kW at a frequency of 188.55 Mc/s. The polarization is horizontal for both video and sound and the French 819-line standard is used, requiring of the aerials a bandwidth in excess of 10 Mc/s. The standard arrangement for France of single sideband transmission is retained.

Next year the power will be increased and the coverage improved as a result.

Preliminary reports of reception indicate very satisfactory results, with clear and steady pictures at St. Tropez, 50 miles from the transmitter. Since the signal travels partly over water to some of the towns to be served by the main lobe, this result is probably to be expected, but it is also reported that good reception is obtained at inland towns such as Draguignan, at which position the signal path is over soil which is notorious for its poor conductivity.

The studios from which the programmes originate are situated in the town of Monte Carlo some 3,000ft below and two miles from the transmitter aerials. In order to avoid the use of buried coaxial cables and their attendant expense for installation and maintenance, and in order to avoid phase distortion in the cables, a duplicated 4-cm radio link conveys the modulations to the transmitters.

The sponsors of the Monte Carlo television station are the "Images and Sound" group, which also operates the Saar television station and which will shortly put into service the extra high-power sound broadcast station for sponsored programmes at Felsberg.

The commercial programme policy of this group is original and differs from that practised in the U.S.A. in several respects. As an example, the group themselves arrange and compose the programmes which are acquired by the publicity organization and the advertising matter is integrated into the programme in a restrained way. Also, the publicity is restricted to one minute every quarter of an hour.

WORLD OF WIRELESS

Colour Prospects • Anglo-French TV Link • B.B.C. Band II Frequencies • Another "Festival of Sound"

Television News

RECENT pronouncements on the possibilities of the introduction of colour television by the B.B.C. within the next two years have been clarified by E. L. E. Pawley (head of Engineering Services). He points out that the decision has yet to be made by the Government (with the advice of the T.A.C.) whether or not we are to have a compatible system. The B.B.C. Research Station is in fact experimenting with the American N.T.S.C. compatible system adapted to our 405 lines with a 5 Mc/s bandwidth, but is also working on a non-compatible system. This would require a greater bandwidth and, therefore, could not be accommodated in the present channels in Bands I and III. Sir George Barnes, B.B.C. director of television, thinks a decision may be reached by the end of the year.

As part of the permanent cross-channel television link to be established by the Post Office a two-way cable link between London and St. Margarets Bay is to be rented permanently by the B.B.C. Presumably the Post Office will be able to provide similar facilities for the I.T.A. should they be required. Until the permanent stations for the cross-channel link are set up in about three years' time the cable will be extended from St. Margarets Bay to Swingate, near Dover (a distance of about two miles), where the B.B.C.'s temporary radio link with Cassel is installed.

Test transmissions from the temporary low-power television transmitter at Tacolneston, 10 miles south west of Norwich, started on January 17th. It is planned to bring the station into regular service on February 1st. Operating in Channel 3 (carriers 56.75 Mc/s vision and 53.25 Mc/s sound, slightly offset) with horizontal polarization, the temporary station will serve an area bounded by Aylsham, East Dereham, Watton, Diss, Beccles and Acle. Vision signals from Alexandra Palace will be picked up near Bury St. Edmunds and relayed by radio to the transmitter site. Sound will be conveyed from Alexandra Palace by line.

For testing Band III aerials and receivers under practical conditions a test-pattern vision signal is to be radiated from a temporary 1-kW transmitter near the site of the I.T.A. South London station. The transmissions, which are due to start on April 1st, are to be conducted by Belling & Lee.

Baird Memorial

AN appeal for funds for a Baird memorial has been launched by the Royal Technical College, Glasgow, where Baird was a student from 1906 to 1910. It is proposed by the governors of the college to establish an annual memorial lecture on developments in television and related fields and to provide a Baird prize in the Department of Electrical Engineering. Donations to the Baird Memorial Fund should be sent to the Secretary/Treasurer, Royal Technical College, George Street, Glasgow, C.1.

V.H.F. Broadcasting

WITH the announcement of the P.M.G.'s approval of an additional v.h.f. station at Wenvoe—making 10 so far approved by the Government—the B.B.C. has made known the frequencies to be used by the 30 transmitters at these stations. The frequencies, together with the e.r.p. for each transmitter, are given in the table below. Incidentally, with the exception of those for Holme Moss and Blaen Plwy, the frequencies conform to the plan for Band II drawn up at Stockholm in 1952. The frequencies given for Wenvoe, however, have yet to be confirmed by the Post Office.

	Home (Mc/s)	Light (Mc/s)	Third (Mc/s)	E.R.P. (kW)
Wrotham (Kent)...	93.5	89.1	91.3	120
Pontop Pike (Co. Durham) ...	92.9	88.5	90.7	60
Divis (N. Ireland)	94.5	90.1	92.3	60
Meldrum (Aberdeenshire) ...	93.1	88.7	90.9	60
N. Hessary Tor (S. Devon)	92.5	88.1	90.3	60
Sutton Coldfield (Warwicks.) ...	92.7	88.3	90.5	120
Norwich	94.1	89.7	91.9	120
Blaen Plwy (Cardigan.)	93.1	88.7	90.9	60
Holme Moss (Yorks.) ...	93.7	89.3	91.5	120
Wenvoe (Glam.)...	94.3	89.9	92.1	120

When announcing the inclusion of Wenvoe in the first batch of v.h.f. stations, scheduled to be completed by the end of 1956, the P.M.G. stated that the Television Advisory Committee had recommended the adoption of the B.B.C.'s long-term plans for v.h.f. development. We understand that these provide for a total of 26 stations, at most of which there will be three transmitters or even a fourth where a station serves two regions.

Repeat Performance

AS announced in December, G. A. Briggs, of Wharfedale Wireless, is giving another lecture-demonstration on sound reproduction at the Royal Festival Hall, London, on May 21st. Tickets are priced 5s 6d and 3s 6d. Within a few days of the announcement of prices, all the tickets for the cheaper seats were sold, but as we go to press there are still some 5s 6d tickets available from "hi-fi" dealers in London.

Mr. Briggs is also giving a similar demonstration in St. George's Hall, Bradford, on April 1st, at 7.30. Tickets at 3s 6d and 2s are available from J. Wood & Sons, Sunbridge Road, Bradford.

Valve "Balance of Trade"

WHILE the exports of valves and c.r. tubes continue to decrease imports of these accessories have increased by over 100 per cent during the past year.

Exports of valves during the first eleven months of 1954 (the latest analysed figures available) totalled £1,743,692, and cathode-ray tubes £122,729, whereas the comparative figures for 1953 were £1,867,079 and £147,590. The actual numbers of valves and cathode-ray tubes exported were 4,447,548 compared with 4,643,005 in 1953.

Figures for the first eleven months of 1954 compared with the same period in 1953 show an increase of 131 per cent in the number of valves imported and 66 per cent in the number of c.r. tubes coming into the country. The total value of these imports was £3,075,419 compared with £1,679,352 the previous year.

"*Wireless World*" *Index*

THE index to the material published in *Wireless World* during 1954 is now available from our Publishers, price 1s (postage 2d). It includes both general and classified indexes. Cloth binding cases are also obtainable with index, price 6s 5d by post. The binding of readers' own issues can be undertaken by our Publishers, the cost, including binding case and index, being 17s 6d plus 1s 4d postage on the bound volume.

NEW YEAR HONOURS

Among those receiving decorations in the New Year Honours List are:—

C.M.G.

R. C. McCall, assistant director of television, B.B.C.

O.B.E.

J. Clarricoats, general secretary, Radio Society of Great Britain. (See "Personalities.")

V. M. Roberts, manager, electronic sales department, B.T-H. (See "Personalities.")

M.B.E.

S. W. Brown, chief radio officer (I.M.R.C.) of s.s. *Scythia.*

D. Fairweather, chief of crystal production, Marconi's W.T. Company.

H. L. Peddle, signals officer, telecommunications department, Ministry of Transport and Civil Aviation.

J. J. Sarche, chief inspector, Ultra Electric, Ltd. (See "Personalities.")

B.E.M.

R. Carter, laboratory mechanic, Royal Navy Signal School.

C. W. Jacobs, chargehand (mechanic), Radar Research Establishment, M.o.S.

PERSONALITIES

B. G. H. Rowley, M.A.(Oxon), A.M.I.E.E., Marconi's technical representative in the U.S.A. and Canada since 1950, has been appointed manager of Marconi's Maritime Division in succession to **G. R. Tyler,** who, although having reached retiring age, is continuing with the company as its representative in West Africa. Mr. Rowley was concerned with the development of marine radar at R.N. Signal School at the beginning of the war and was subsequently appointed to the staff of the British Admiralty delegation in Washington. From the end of the war until joining Marconi's he was staff radar officer (Lt. Cdr.) with the Joint Services Mission in America.

Dr. W. J. Thomas, Ph.D., B.Sc., A.M.Brit.I.R.E., has left the Norwood Technical College where he has been since 1947—for the last four years as principal. He has been appointed one of H.M. Inspectors of Schools, the major part of his work being concerned with technical colleges in South Wales. It was largely due to his interest that the Television Society's experimental transmitter was installed in the college, which also houses the society's museum. For a short period at the beginning of the war Dr. Thomas was education officer at the R.A.F. Radio School, Cranfield, and from 1942 until the end of the war was senior instructor at the Army Radio School, Petersham, Surrey.

John Clarricoats, G6CL, the well-known general secretary of the Radio Society of Great Britain, who is appointed an O.B.E. in the New Year Honours, recently completed 25 years' service with the society. In addition to receiving a gift from the members, mentioned last month, he was also awarded the R.S.G.B. Calcutta Key "in recognition of his outstanding service to the cause of international friendship through the medium of amateur radio."

Vernon M. Roberts, B.Sc., A.M.I.E.E., appointed an O.B.E. in the New Year Honours, has been with B.T-H. since 1924, when on graduating at the University of Wales he started a three-year student apprenticeship. During the war he was concerned with the development and production of radar equipment. He is now manager of the company's electronic sales department and a director of Multi-Broadcast (Engineering), Ltd. Mr. Roberts has for some years represented B.T-H. on the Radio Communication and Electronic Engineering Association, of which he was chairman in 1950.

J. J. Sarche, who has been appointed an M.B.E., has been with Ultra Electric, Ltd., for 33 years. He is now chief inspector at the company's Western Avenue factory, having previously been assistant chief engineer.

F. E. Debenham, the new manager of the Service Department of Mullard's Valve Division, at Waddon, Surrey, has been with the Mullard group of companies since 1929. For some years during the war he was production manager at the Mullard valve factory at Blackburn. He succeeds **E. B. Rogers,** who has retired after 28 years with the Service Department.

J. CLARRICOATS, O.B.E.

V. M. ROBERTS, O.B.E.

J. J. SARCHE, M.B.E.

F. E. DEBENHAM

David L. Davies, B.Sc., Grad.I.E.E., has been appointed chief electronics engineer of Winston Electronics, Ltd., of Hampton Hill, Middlesex. Graduating at University College, Swansea, in 1948, he joined the staff of the Engineering Department of Edinburgh University, where he was lecturer in electrical engineering for three years. Immediately prior to joining Winston Electronics last January, at the age of 26, he had been working on guided missiles with English Electric.

E. J. Gargini, author of the article "Piped Scanning Waveforms" in this issue, received his technical training at Southall Technical College. After a short period as a trainee at the E.M.I. and Philco organizations he served in the R.A.F. during the war. He rejoined the E.M.I. Group in 1945, where he has been concerned in the design of cinema sound equipment, multi-channel radio-frequency relay systems, and wired television distribution equipment. He has been recently seconded to the research organization to work on domestic colour television.

Arthur W. Wayne, who describes a simple wave-shaper elsewhere in this issue, is both a professional engineer and a professional musician, a combination which he finds invaluable as a designer of sound-reproducing equipment. He has been a consultant dealing chiefly with acoustics for some years and last year formed Shirley Laboratories, Ltd., of Worthing, for the manufacture of amplifiers, tuners and electronic instruments.

IN BRIEF

The annual I.E.E. **Faraday Lecture,** which is "designed to appeal to the layman," is this year being given by T. B. D. Terroni, B.Sc., manager and chief engineer of the Transmission Division of the Automatic Telephone and Electric Company. His subject is "Courier to Carrier in Communications." The lecture will be delivered at the Central Hall, Westminster, on January 27th, at 6.0. Tickets must be obtained from the I.E.E., Savoy Place, London, W.C.2.

The demand for admission to the laboratory course in **Pulse Techniques** to be held at the Borough Polytechnic, Borough Road, London, S.E.1, on twelve Wednesday evenings, beginning on February 23rd, has been so great that it is to be repeated. It will be given on Monday afternoons from April 18th and again on Wednesday evenings from April 20th. The fee is 2 guineas.

A Spanish Edition of Scroggie's "Foundations of Wireless" has been published with the title "Fundamentos de Radioelectricidad." It has been produced by Editorial Alhambra, S.A., of Madrid, and costs 195 pesetas.

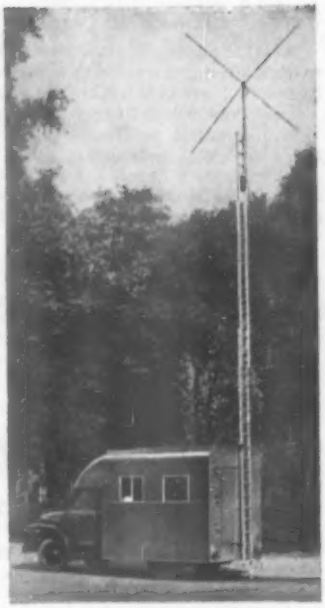
North America's third distant early warning (DEW) radar chain will be within the Arctic Circle. The first, now almost complete, runs across southern Canada, and the second is on the 55th parallel.

Soviet Colour Television.—Experimental transmissions of field-sequential colour television have recently been radiated from the Moscow television centre. An additional mast has been erected at the centre and a specially equipped studio is to be provided.

CLUB NEWS

Birmingham.—At the meeting of the Slade Radio Society on February 18th at 7.45 at the Church House, High Street, Erdington, R. Rew (G3HAZ) will give a lecture demonstration on "Equipment for Seventy Centimetres."

Cleckheaton.—Two *Wireless World* contributors will be giving lectures to the Spen Valley and District Radio and Television Society in February. On the 9th at the Temperance Hall, Cleckheaton, Dr. K. A. Exley will speak on audio reproduction, and on the 22nd at the Bradford Technical College, Dr. G. N. Patchett will deal with transistors. Both meetings begin at 7.30.



MOBILE v.h.f. test unit, with aerial mounted on a 40-ft extensible ladder, has been brought into service by Philips for field-strength measurements. Interchangeable aerials are carried and these are electrically rotated.

Newark.—"Transistor Circuitry" is the subject of the talk to be given by C. L. Wright (G3CCA) to the Newark and District Amateur Radio Society at 7.0 on February 6th at the Northern Hotel, Newark.

Windsor.—In response to requests from past and present students of the East Berkshire College, a radio society has recently been formed and meets on Thursdays at 7.0 at the Royal Albert Institute, Windsor. Details of the facilities provided by the club, which has its own transmitter, G3KAL, are obtainable from F. H. Rickards, East Berks College, Royal Albert Institute, Windsor.

Leicester.—A member of the Leicester Radio Society will speak on power supplies at the meeting on February 14th. A fortnight later the chairman will deal with grid-dip oscillators; their construction and application to amateur radio. Meetings are held at 7.30 at the Club Room, Holly Bush Hotel, Belgrave Gate, Leicester.

BUSINESS NOTES

Baird-Ambassador Merger.—Hartley Baird, Ltd. (formerly Baird Television), of 37, Thurloe Street, South Kensington, London, S.W.7, manufacturers of television receivers and tape recorders, has acquired Ambassador Radio, the well-known manufacturers of domestic radio and television sets. R. N. Fitton, managing director of Ambassador, has joined the board of Hartley Baird as director in charge of radio and television. Ambassador will continue to operate as a separate company.

A contract has been awarded to **Nash and Thompson, Ltd.,** Tolworth, Surrey, for the electrical, physical and mechanical testing of electronic components, excluding valves, to the requirements and under the direction of the Radio Components Standardization Committee. Claimed to be the first of its kind to be granted to a commercial undertaking it supplements the testing and proving of newly designed equipment carried out by the Government research establishments.

The "Martinet" automatic steering device for small craft developed by **Hartley Electromotives, Ltd.,** will be produced at their Shrewsbury factory, but the **Marconi Marine Company** will be the sole concessionaires. The device was shown for the first time on the joint Marconi-Hartley stand at the recent National Boat Show at Olympia.

The name of Blick Engineering, Ltd., of Bedesway, Bede Trading Estate, Jarrow, Co. Durham, has been changed to **Blickvac Engineering, Ltd.** The company, which manufactures high-vacuum impregnators, potting resin impregnating and casting plant and other high-vacuum equipment, has a London technical representative at the offices of the associated company, Blick Time Recorders, Ltd., 96-100, Aldersgate Street, London, E.C.1 (Tel. Monarch 6256).

A new prefabricated factory building is being erected at Shepperton for **Winston Electronics, Ltd.**, who develop and manufacture electronic equipment for the Services, for many diverse branches of industry and for telecommunications.

The London sales office of **Pye Marine, Ltd.** (formerly Rees Mace Marine) at 11, Hinde Street, W.1, is now closed and the London area sales and service headquarters are at Galleons Works, Yabsley Street, E.14 (Tel. East 4216). The office of R. I. T. Falkner, the sales director, is now 157, Regent Street, London, W.1 (Tel. Regent 2712).

Excel Sound Services, manufacturers of the Celsonic tape recorder, were given the task of recording the Bradford Festival Choral Society's recent concert and from the tape produced discs of the programme highlights for members of the society.

Two British aircraft manufacturers—de Havilland and Bristol—are now using miniature **Pye Industrial TV** cameras for research purposes. In one case the equipment is being used to detect the presence of flame in a new engine being tried out in the bomb bay of a test aircraft. The camera is focused on to the engine (which is in complete darkness) through a heat-resistant glass panel. While the monitor on the pilot's dashboard is blank he knows that all is well.

The reconstructed premises of the **G.E.C.** in Wellington Street, Leeds, destroyed by fire two years ago, were reopened in December.

FOREIGN TRADE

Each of the 40 Vickers-Armstrong Viscount aircraft ordered by Capital Airlines (U.S.A.) is to be fitted with **Marconi** automatic direction finders. The standard Marconi radio compass has been modified for operation in North America.

U.S. Import Tariff.—A three-fold increase in the import tariff on radio and electronic equipment is called for by the American Radio-Electronic-Television Manufacturers' Association. The duty was reduced from 35 per cent to 12.5 per cent in 1951. The R.E.T.M.A. states in a report quoted by the *Financial Times* that imports from the U.K. in the first eight months of last year totalled $607,000, compared with $463,000 for the whole of 1953. During the same periods imports from Germany were $295,000 and $109,000, respectively.

S.T.C. and **Marconi's** have jointly been awarded a contract for supplying radio-telephony and telegraphy equipment for a new external telecommunications station being built in Addis Ababa, Ethiopia. S.T.C.'s share of the contract includes two 4-kW transmitters; telephone terminal equipment providing two simultaneous telephone channels and voice-frequency telegraph equipment providing two telegraph channels. Marconi's will be responsible for the receiving equipment and aerial installations.

The Near East Arab Broadcasting Station at Limassol, Cyprus, from which commercial programmes are broadcast to the Arabic speaking countries, is being equipped with a 100-kW medium-wave transmitter and a 20-kW short-wave transmitter by **Marconi's.** Twin 350-foot directional mast radiators have been erected by **B.I. Callenders.** The station operates on 635 kc/s and in the 25, 31 and 49 metre bands.

PUBLICATION DATE

As already announced *Wireless World* now appears on the fourth Tuesday of the month preceding that for which it is dated. The March issue will, therefore, be published on February 22nd

Radel, Ltd., of Strand Road, Ashar, Basrah, are interested in acting as **Iraq Agents** for British radio and electronic equipment and are also seeking tenders for the supply of 500 domestic receivers. They require wired chassis with accessories but with a "prefabricated cabinet to be assembled on site." The universal 5-valve receiver must cover two short- and one medium-wave band, operate on 230 V and have Arabic characters on the tuning scale. Interested manufacturers should communicate in the first place with the company's British representative, L. C. Jenkins, 460, Wilbraham Road, Manchester, 21 (Tel. Chorlton 1801).

Cossor's have supplied four medium-power communications installations (No. 53) to the ruler of Kuwait, Persian Gulf. The equipment, which can be operated as a mobile or fixed station, has facilities for c.w., m.c.w. and R/T, and can be remotely controlled.

MERCHANT SHIPPING R/T

UNDER the Merchant Shipping (Radio) Rules, 1952, it is compulsory for all vessels between 500 and 1,600 tons (which class includes small coasters, tramps, tugs and large fishing craft) to carry radio-telephone equipment. These rules came into force on November 19th last year, and the first transmitter-receiver to be granted the G.P.O./M.o.T. Certificate of Approval as meeting the specification laid down in the rules is the Pye Marine "Swordfish." The 50-watt transmitter is crystal-controlled on eight spot frequencies (between 1,600 and 3,900 kc/s) which are switch selected. The receiver

oscillator is also crystal-controlled, and in addition to covering the same frequency range as the transmitter the set provides for reception on 200 kc/s (Droitwich). The combined set measures 24in high × 20in wide × 10in deep.

INTRODUCTION TO Transistor

I—Physical Basis of Conduction in Semi-Conductors

THE object of this article is to give the reader as clear a working picture of transistor electronics as he has about valve electronics. It is inevitable that such a working picture should be incomplete: in these days theories which deal with all the known facts—where they exist at all—can be expressed only with the aid of mathematics. What is needed, therefore, is a theory which expresses clearly and accurately facts of interest to the engineer rather than those which are needed by the research physicist.

This article is concerned mainly with what happens within the crystal itself and not with transistor circuits. The theory of conduction in semi-conductors (the class in which the germanium crystal falls) is discussed first. This requires an explanation of the structure of these crystals and of the effects due to the presence of certain impurities. These impurities are essential to the production not only of the transistor action but also of the rectifying effects which make the germanium diode possible.

Conduction in Semi-Conductors.—The name semi-conductor applies to a group of elements of crystalline structure, which conduct electricity poorly in general, but which may, in association with discontinuities in the material, have different conductivity for currents flowing in opposite directions. The atoms of the group with which we are concerned have four valency bonds and four electrons in their outer orbits. Carbon and silicon are the commonest of these elements; germanium is rather less abundant. Until recently, in fact, germanium was a rather rare chemical curiosity of little importance, which formed a small proportion of the flue dust which collects in chimneys.

Germanium and silicon form symmetrical crystals, the atomic structure of which is represented in Fig. 1. All the valency bonds are used in forming the structure, each bond being an electron pair. In this perfect crystalline structure there are no free electrons and conduction in the ordinary sense, such as in a metal, by free circulation of electrons, is not possible. A crystal of this nature does, however, conduct some current, and for both germanium and silicon, this current is affected by light falling on the crystal and also by its temperature.

Fig. 2 shows a diagram of the four-valency structure, suitably flattened to two dimensions for simplified illustration. All the valency bonds are satisfied and all nuclear charges neutralized. As it stands there is no form of "carrier" for any electric current. But both thermal energy due to temperature and the radiant energy of light (and higher-frequency radiations) disturb this quiescent state. Either may be imagined to shake the structure; and under certain conditions one of the valency electrons may fly off. This, as seen in Fig. 3, leaves an incomplete bond —a resultant positive charge—which is called a "hole."

It is not difficult to see that a number of electrons so shaken off may become an electrical current if a potential difference exists across the crystal; but it is not so easy to picture holes as being very nearly as effective carriers of electric charges. Surprising as it may seem, a hole has very much the same order of mobility as an electron, though it appears to move in the opposite direction. An explanation of the process is simple enough. When subject to an electric field the stress on a neighbouring valency electron causes it to "jump" into the hole, leaving another hole where it came from; this causes the next one to do likewise, and so on. The hole appears then

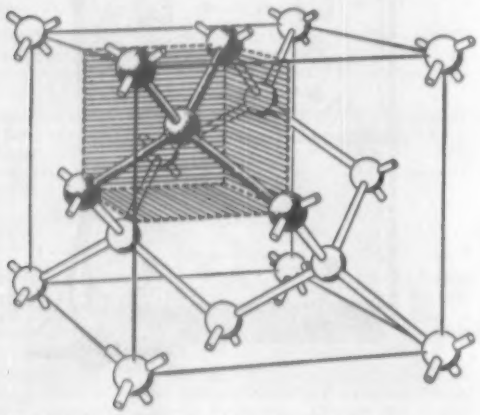


Fig. 1. Atomic structure of a germanium crystal.

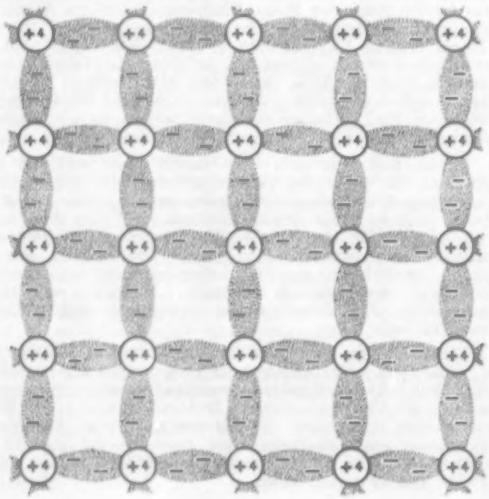


Fig. 2. (Right) Representation of valency bonds in silicon or germanium.

Electronics

By H. K. MILWARD, B.Sc., A.M.I.E.E.

to move from the positive end to the negative. What is most surprising is not that this happens but that it happens so quickly.

One might imagine that electrons moving this way and holes moving that way would frequently "collide" and neutralize each other. While this happens to some extent it does so in a well-regulated and orderly fashion. Experiments have shown that in general hole-and-electron pairs are generated (and may recombine) only at specific points in the crystalline structure. Irregularities in the crystal structure are an example of such points, though the exact condition necessary for the formation of a generation-and-recombination centre are as yet by no means completely investigated. There would be little point in discussing the present theory here, for it is possible to get a fairly accurate action picture of the transistor from what has been found by experiment. The theory leads straight into quantum mechanics and to realms where simple analogies are quite unusable.

An electron or a hole may be "trapped" in such a centre, where it is held until a hole or an electron comes near enough to be attracted and to combine. Since neither production nor recombination of hole-and-electron pairs is entirely indiscriminate, their lifetime is perhaps rather longer than might be expected.

The conductivity of a semi-conductor depends upon the number of free electrons and holes present, and upon their mobility. The number present depends upon equilibrium between the rate of production and the rate of recombination of such pairs. The rate of production is dependent on incident light or ambient temperature and the rate of recombination, being statistically related to the number which arrive at the recombination centres, depends upon the density of the electrons and holes. Any equilibrium state requires the rate of production and recombination to be the same. Thus the conditions which produce a greater rate of production also cause a higher density of carriers, and, therefore, a higher conductivity. An indication of the dependence of the recombination rate on the density has been given by an experiment which measures conductivity in comparison with incident light; this also shows that the die-away of conductivity, after the light has been shut off, is exponential.

When a hole and free electron are formed by thermal or photo action they move in a random way, similar to the motion of a very small particle in a liquid due to Brownian movement. A number of holes and electrons formed or introduced at a point in the crystal structure diffuse throughout at a rate governed by this random movement, which is itself dependent on temperature. The diffusion rate for an electron in germanium is 93 cm^2/sec and for a hole 43 cm^2/sec. The rate is dependent on temperature and the figures quoted are for 300°K (27°C) and for fairly pure samples of germanium. The most surprising thing is to find that holes and electrons have mobilities which are not very far different.

The conductivity of a semi-conductor is conditioned by temperature and by incident light, but certain impurities in the structure have a much greater effect. For example, "impurity atoms" with five valency electrons fit more or less perfectly in the structure, except that for each impurity atom there is a shortage of one electron. Fig. 4 shows this effect. The atomic nucleus has five units of positive charge and, therefore, is an attracting force for the electron which has been left out of the four-valency structure; but the energy due to temperature is normally enough to cause the electron to diffuse throughout the structure, and not to remain near its parent atom. This is much aided by the reduction of attractive force due to the dielectric constant of the material, which for germanium is 16. Each "spare" electron is, therefore, a potential carrier of electric current. The density of such carriers in a sample is equal to the

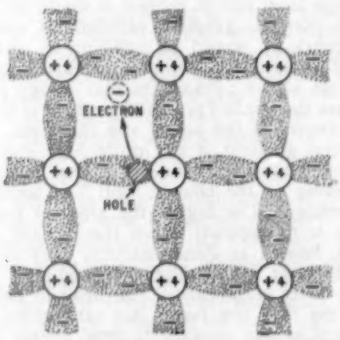


Fig. 3. "Hole" left by electron having "jumped" out of its place, due to thermal or photo effects.

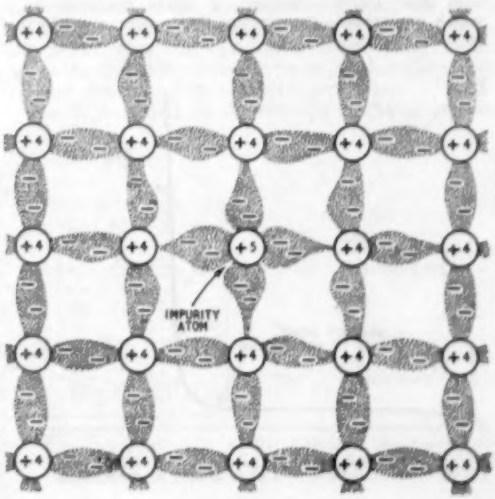


Fig. 4. Illustration of a donor atom in the structure. The effect of the dielectric polarization due to the extra positive charge on the nucleus is shown. The extra electron is assumed to have diffused away from the parent atom and is not shown.

density of impurity atoms, and the overall conductivity is proportional to the total density of such carriers in the sample.

Such an impurity atom is called a donor. Arsenic and antimony are typical donors for germanium and silicon. A concentration of one donor atom to 10^8 of pure germanium is sufficient to increase very greatly the conductivity at ordinary temperature; and although hole-and-electron pairs are still formed as in pure germanium, conduction is due mainly to the donated free electrons.

Germanium which has donor impurity atoms is called negative or *n*-type, because the conduction through it is by means of negative carriers.

There is another sort of impurity which has an equally marked effect on conductivity, and that is the atom with three valency electrons. Examples of this are aluminium, gallium, and boron. These also fit into the crystalline structure without disarranging it,

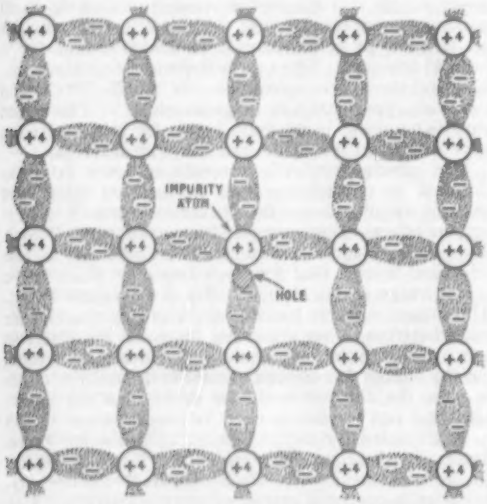


Fig. 5. An acceptor atom shown in the structure. The "hole" diffuses away from the parent atom leaving it with four orbital electrons. In these circumstances, which are normal, the acceptor atoms have a resultant negative charge.

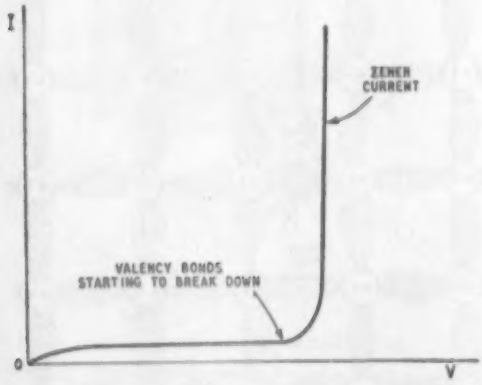


Fig. 6. Zener current in a pure sample of germanium.

but in this case there is an electron missing, instead of one too many. In addition, a nuclear positive charge is missing. The incomplete bond in the structure causes a hole, as seen in Fig. 5. It is perhaps surprising that this sort of hole moves as freely as one caused by light or thermal energy, and diffuses away from the parent atom in a similar way to the donated electron in the previous case. Such an impurity is called an acceptor and the material is then called positive or *p*-type, because the current carriers are holes.

A remarkable effect is shown when the two types of impurity are mixed. The free electrons given by the donor atoms fill the holes from the acceptor atoms, and the balance of holes or electrons remaining carry any current which flows. It is clear, therefore, that if the acceptors and donors are present in equal quantities there are no carriers left, except the hole-and-electron pairs which are generated spontaneously in germanium anyway: the conductivity of the material is then no higher than that of the pure material. Because a small excess of one or other of the impurity atoms causes such a marked change in conductivity the exact proportion to produce this sort of equality is difficult to control in manufacture.

Where both acceptors and donors are present the charge distribution throughout the crystal is uneven when viewed on an "atomic" scale. Each acceptor atom which has had its hole filled represents a resultant negative charge and each donor atom which has lost its fifth electron is a positive charge. There are, therefore, a number of opposite charges fixed in the structure, though the whole is electrically neutral by reason of the mobile charges.

There is one further effect which must be mentioned before the action of the crystal diode and triode can be understood. This is the effect of a large electric field on the production of holes and electrons. When the potential gradient reaches a certain value (the actual value being dependent to some extent on the impurity content of the material) the valency bonds of the structure begin to break up. The effect of such a breaking-up is for a hole to make off towards the negative end and the corresponding electron to the positive end.

All the valency electrons are at more or less the same energy level and in general it would be true to say that a potential gradient sufficient to cause one bond to break up would be sufficient to cause this effect in all other bonds. In practice this is not quite true because of the random thermal energy present, and because the applied potential gradient is modified by the presence of the atoms and electrons. When the potential gradient is not quite high enough to cause spontaneous breaking-up a few bonds will rupture owing to the chance "gift" of some extra thermal energy. The higher the gradient the more likely this is to happen; hence the current due to this effect, known as Zener current, does not start as abruptly as at first it might be imagined. Fig. 6 shows the effect graphically. The bend in the curve is where the first few bonds are torn apart, when the electrical energy plus the thermal energy chance to be sufficient. As the potential gradient is increased more and more valency electrons are able to acquire sufficient energy to break away. The steep part of the curve represents the state in which the electric field supplies nearly all the energy and most of the valency electrons have sufficient energy to break away.

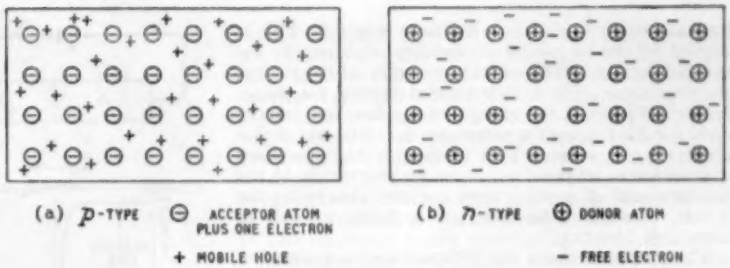
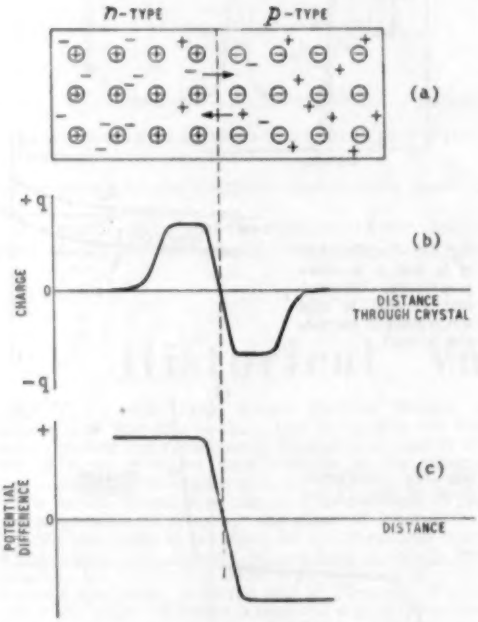


Fig. 7. Presentation of acceptors and donors in the crystalline structure of germanium or silicon.

Fig. 8 (Below). Junction under conditions of thermal equilibrium.



It might at first be supposed that this Zener current would disrupt the crystal structure physically, but this is not so. A current produced in this way is quite stable and the point at which the sharp increase occurs is not particularly temperature-sensitive.

p-n Junctions.—Having seen something of what happens in pure and impure material, it is possible to examine the effects at a junction between *p*-type and *n*-type material in a single crystal. A possible method of producing such a junction is easy enough to imagine. Arsenic, for example, will diffuse into a germanium crystal which is made hot enough. If one face of a crystal (having already an acceptor impurity such as aluminium) were exposed to arsenic and heated sufficiently, the arsenic could diffuse into the crystal from one end. We have already seen that the material is *p*- or *n*-type according to the majority impurity. In this case the *p*-type material becomes *n*-type from one end and a dividing layer must, therefore, exist which is "neutral," having an equal concentration of acceptors and donors. On one side of this layer acceptors are in the majority: on the other side donors.

For the purpose of illustration *p*-type and *n*-type crystal structure is represented by showing only the acceptor or donor atoms in the structure and the consequent mobile holes or electrons. Fig. 7 (a) shows the *p*-type material and Fig. 7 (b) the *n*-type. The acceptor atoms are fixed in the crystalline structure and have the extra valency electrons to which they are not really entitled, hence they have a resultant negative charge. The holes which have wandered away from the parent atoms have an equal positive charge. The material is, therefore, electrically neutral as a whole although throughout the material there are these discrete charges, both fixed and mobile. The donor atoms are similarly fixed but have a positive charge because the fifth electron has wandered away.

When two different materials meet in a junction such as that described above, the holes in the *p*-type material and the electrons in the *n*-type material, diffusing in the normal way, cross the boundary into the other sort of material. As we have seen, each side starts electrically neutral, but as holes cross from the *p*-type to the *n*-type and electrons go the other way, the *n*-type material acquires holes and loses electrons, thus becoming positively charged; while the *p*-type does the opposite and becomes negatively charged. An illustration of the structure is seen in Fig. 8 (a). A standing potential difference is produced between the two materials, and the size of this is regulated by the rate of diffusion across the boundary, the production and recombination rates, and the current of holes or electrons in the reverse direction due to the generation of holes in the *n*-material and electrons in the *p*-material. The potential difference is opposed to the diffusion current and equilibrium is eventually reached when the diffusion current is no larger than the reverse current due to the spontaneous generation.

Fig. 8 (b) shows the distribution of charge over the

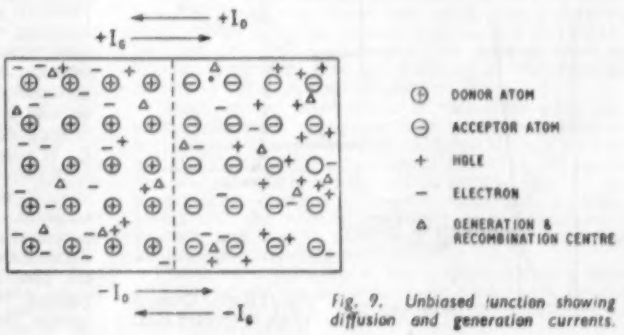


Fig. 9. Unbiased junction showing diffusion and generation currents.

junction when equilibrium has been reached. This is caused by the repulsion of the free electrons in the *n*-type material by the negative potential of the *p*-type, and *vice versa*. The mobile current carriers are, therefore, repelled from the vicinity of the junction, leaving only the fixed acceptor atoms on one side and donor atoms on the other. This leads to a high resultant concentration of positive charge on the *n*-side of the junction and an equally high negative charge on the *p*-side. Only the fast electrons or holes are able to cross this "barrier."

The reverse current due to spontaneous generation previously referred to arises from the fact that hole-and-electron pairs are generated thermally or photo-electrically on both sides of the junction. On the *n*-side the electrons merely add to the free electrons produced by the donors, but the holes, if produced close to the junction, "slide down" the potential gradient to the other side. The equilibrium potential is thus automatically adjusted until the diffusion current exactly equals the generation current. This is true of both holes and electrons. Fig. 9 shows this diagrammatically, with a reminder about the presence of production and recombination centres.

When the junction is biased the effects which produce rectification can be seen. If the junction is forward biased, as shown in Fig. 10, the standing potential difference between the *n*- and *p*-materials is reduced. The holes in the *p*-side now find it easier to diffuse to the *n*-side, so that the diffusion current is increased. The reverse generation current is virtually unaltered, because it is controlled by temperature and incident light only. The two currents are, of course, no longer in equilibrium and the difference flows in the outside circuit. A further increase of bias removes the reverse potential gradient at the junction entirely and the *n*-side becomes negative in potential while the *p*-side becomes positive. This means that holes are attracted directly across the junction, as are electrons in the opposite direction. The current is no longer a diffusion current but one in which the carriers

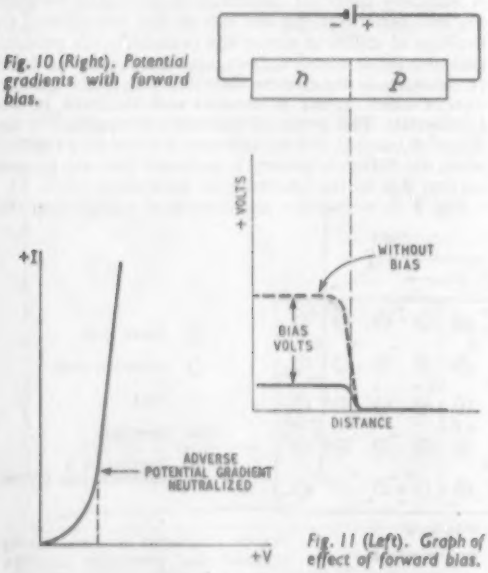


Fig. 10 (Right). Potential gradients with forward bias.

Fig. 11 (Left). Graph of effect of forward bias.

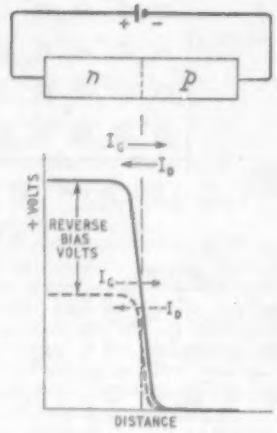


Fig. 12. Reverse bias. Note that the generation current I_G is virtually unchanged by reverse bias while the diffusion current I_D is decreased considerably.

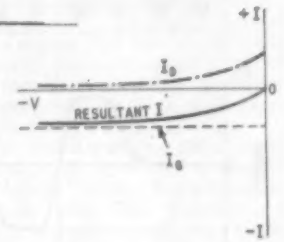


Fig. 13. The alteration of I_G and I_D is shown graphically. The resultant current is that which flows in the outside circuit.

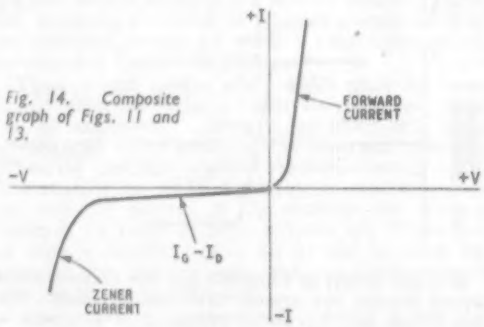


Fig. 14. Composite graph of Figs. 11 and 13.

are moving under the direct influence of a potential gradient. As the potential gradient increases from zero the rise of current is very rapid, an effect seen in Fig. 11.

Biasing in the opposite direction increases the potential difference between the *p*- and *n*-sides. This increase, which is shown in Fig. 12, reduces the diffusion current I_D but has little or no effect on the generation current I_G. Again the equilibrium is disturbed and the *difference* between I_D and I_G flows in the outside circuit. Increasing the voltage has the effect of reducing I_D eventually to zero, but has no effect on I_G, as seen in Fig. 13.

If this were all, the characteristic curve would be virtually asymptotic to the graph of I_G, which is nearly constant. But it will be remembered that when the potential gradient reaches a certain critical value the Zener current starts to flow, that is, holes and electrons are generated spontaneously by the breaking up of valency bonds. At a certain point, therefore, the reverse current curve shows a sudden increase, and

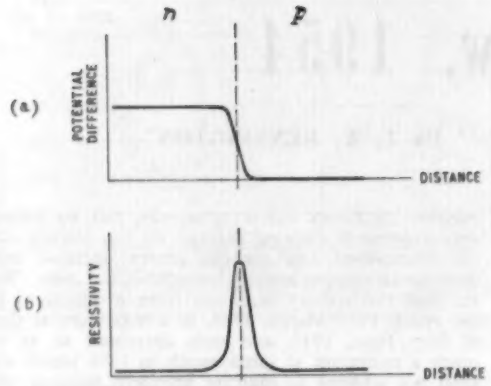


Fig. 15. Graph showing resistivity in different parts of the crystal.

this is shown in the complete characteristic curve at Fig. 14.

It is worth noting that the resistance of the various parts of the crystal may be found very simply by considering the slopes of the curves in Figs. 10 and 12. The graphs show the voltage plotted against distance through the crystal. If we also know the mean current flowing the resistance of any portion of the crystal, or the whole, may be found easily. Again if the cross-sectional area of the crystal is known the resistivity of different portions of the crystal may also be found. Fig. 15 shows clearly that the resistivity is high wherever the potential gradient is steep; in fact, it is proportional to the potential gradient.

The resistance of the junction is, therefore, dependent on the bias and is high when back biased and low when forward biased.

REFERENCES

1. Shockley, W.: "Transistor Electronics." *Proc. I.R.E.*: Nov., 1952.
2. Morton, J. A.: "Present Status of Transitor Development." *B.S.T.J.*, May, 1952.
3. Conwell, E. M.: "Properties of Silicon and Germanium." *Proc. I.R.E.*: Nov., 1952.
4. Roddam, T.: "Transistors." *Wireless World*, Feb.-Dec., 1953.

Acknowledgement.—Figs. 1, 2 and 4 are based on Figs. 1, 3 and 12 respectively of reference 1 above.

(*To be continued*)

Historical Valve Collection

ABOUT the year 1920, Robert McVitie Weston, a solicitor with scientific leanings, took to building his own radio receivers and consequently became interested in the various types of valves then available to the amateur constructor—and subsequently in the history of the valve.

His interest spread from current types and soon he was collecting valves of every age and type. A great deal of his time was spent in searching for specimens and many a lunch-hour was devoted to combing junkshops for material. By 1934 he had assembled a collection of several hundred specimens, including one of Fleming's original diodes and a Lee de Forest triode with a descriptive label in Fleming's own handwriting. Housed on the top floor of Mr. Weston's Reigate home, the collection rapidly expanded, following his decision to investigate every possible source of material, both at home and abroad, and by 1938 the exhibits numbered about 2,000.

The war interrupted active collecting, and a change of address necessitated dismantling the museum. After the war, with insufficient time or space to restore it, Mr. Weston felt that the collection was too large and too important for a single person to handle. He therefore decided to hand it over to Standard Telephones and Cables, thereby ensuring not only the preservation of the existing specimens but also the expansion of this unique museum by the addition of new and interesting valves.

This, quite briefly, is the story behind the actual accumulation of the historically priceless selection of valves now assembled in the entrance hall of the Radio Building at the New Southgate works of Standard Telephones and Cables. The company hopes to enrich the McVitie Weston Collection with further examples of really significant valves from every possible source, and to this end welcomes the co-operation of valve manufacturers and others throughout the world in providing suitable items for inclusion. Students of the subject will doubtless appreciate this permanent record of the history of the valve, and it will be possible for them to visit the collection by making application to Standard Telephones and Cables.

A central display cabinet contains only those valves which, for their rarity or other special reasons, are of major and lasting interest. For the rest, it is intended to keep the display flexible and to stage from time to time special selections illustrating topical aspects of the subject. The main cabinet in the centre of the hall is actually intended to show the general evolution of the valve from the Fleming diode. Outstanding exhibits are two early Fleming diodes; Lee de Forest audions; a Lieben-Reisz gas triode (the only known unused specimen); and diodes used by Marconi at Poldhu.

There are also two corner cabinets, one of which shows the evolution of the water-cooled valve and the other the evolution of forced-air-cooled and radiation-cooled valves. Water-cooled valves include an early example of the Western Electric 220B, the first commercial water-cooled valve and the type with which the 1922 transatlantic radio telephone experiments were carried out. The development is shown continued through the 1929 Standard Telephones 4030A, an early short-wave valve with integral water-jacket, the Marconi CAT14, the first valve of the very high rating, and includes a modern thoriated tungsten filament valve (S.T.C. 30/260E).

The display of forced-air-cooled valves includes the Marconi ACT (an early type) with various more recent types illustrating the development, and also includes early samples of the silica valve developed by the Admiralty and produced by Mullard.

Another cabinet houses a collection of cathode ray tubes including a very early Braun tube dated 1906; a Western Electric ss4A (a genuine Johnson tube); an S.T.C. 4050AG gas-filled c.r. tube; a gas-focused Von Ardenne tube; an Ediswan projection tube (as exhibited at the Physical Society in 1938); and various modern types.

Trends in the development of valves for v.h.f. and higher frequencies are traced from valves with reduced lead lengths: Marconi Mathieu 1930, 500 Mc/s, 3.5 watts; S.T.C. 4304, 400 Mc/s, 50 watts; S.T.C. 4316, 100 Mc/s; the positive-grid oscillator, S.T.C. 4036A, used in the historic cross-Channel microwave radio link in 1931, 1800 Mc/s; the velocity modulated cavity oscillators—klystron and coaxial tube; and the cavity magnetron oscillator and travelling-wave amplifier.

The drive to reduction of size is illustrated by a series of valves of old designs through the octal, loctal, bantam and miniature types, finishing with sub-miniatures of contemporary design.

Ionosphere Review, 1954

End of a Sunspot Cycle

By T. W. BENNINGTON*

IT is very interesting at those relatively infrequent epochs which mark the end of a sunspot cycle to look back over the years during which the cycle has run its course and to examine the changes in radio conditions which the varying sunspot activity has occasioned. Or rather (should we say?) to examine the changes in radio wave propagation which have been brought about by the changing *ionospheric* conditions, the latter having been produced by variations in the ionizing radiations falling upon the atmosphere from the sun, in accordance with the variations in the sun's activity, visible evidence of which has been given by the sunspots which appeared upon it.

We may here consider that the end of a sunspot cycle occurs at the epoch of minimum sunspot activity, although this is not strictly true because the old and new cycles overlap each other to some extent around the minimum. But for radio purposes we are justified in assuming that sunspot minimum represents the end of a cycle. Sunspot minimum apparently occurred during 1954, and it is this fact which occasions the above remarks. But we have to add that it is rather too early to be quite certain about the matter yet, and it is never wise to jump to conclusions when one is dealing with sunspot cycles. However, by the end of 1954 there were several good reasons for thinking that the sunspot minimum might be past.

General Effect of the Sunspot Cycle:—Let us now look at Fig. 1, in which the full-line curve is a graph of the twelve-month running average of the monthly values of sunspot number, the latter being the measure in which the degree of sun-spottedness is usually expressed. The monthly value of sunspot number fluctuates rather erratically, but by taking a twelve-month running average we can smooth out the fluctuations and see the general increase and decrease in sunspot activity throughout the cycle. We see that the activity increased from a minimum at the epoch Feb./March, 1944, to a maximum at that of May/June, 1947, and then decreased so as to reach a minimum at some epoch in 1954 which we shall not attempt to indicate precisely, because the last 12 values are, as yet, only provisional. The curve is of a "saw-tooth" shape, there being a relatively rapid increase from minimum to maximum, and a much slower decrease from maximum to minimum. This is a general feature of all cycles which have a high maximum—and the maximum of 1947 was the highest since that of 1778—whereas the cycles with low maxima are more or less symmetrical about the maximum, i.e., their increasing and decreasing phases are of similar duration. In this cycle the increasing phase occupied 39 months and the decreasing phase about 83 months, the total duration of the cycle thus being about 10.2 years, as compared with the mean duration of 11.1 years for the cycles which have occurred since 1755. But it was in no way remarkable in differing from this mean, for the cycles vary from about 9 years to about 13 years in duration. The decreasing phase of the cycle was marked by very large and erratic fluctuations over periods of a few months, so large indeed that they appear as peaks and troughs and ledges even in the smoothed curve of Fig. 1. Towards the minimum of the cycle the curve "flattened-out"—as is usual—and the month-by-month variation in the activity was

* British Broadcasting Corporation.

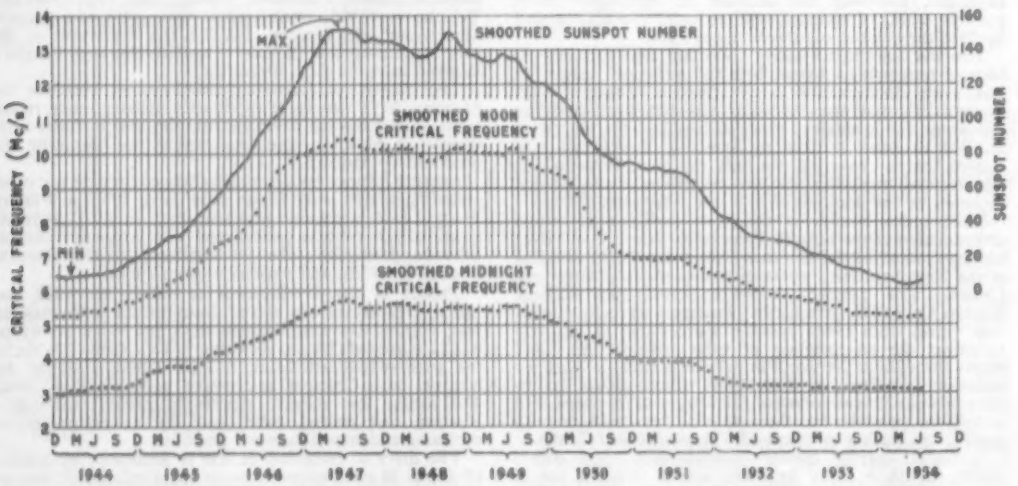


Fig. 1. Twelve-month running average of sunspot numbers and of noon and midnight F_2 critical frequencies over the sunspot cycle.

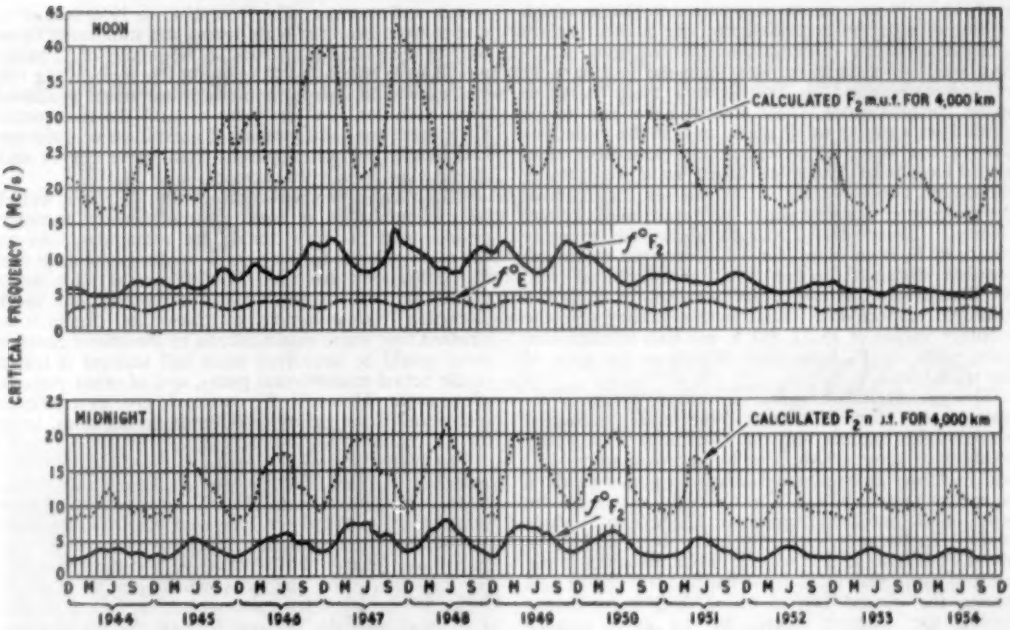

NOON
CALCULATED F_2 m.u.f. FOR 4,000 km
f^0F_2
f^0E
CRITICAL FREQUENCY (Mc/s)
MIDNIGHT
CALCULATED F_2 m.u.f. FOR 4,000 km
f^0F_2
D M J S D M J S D M J S D M J S D M J S D M J S D M J S D M J S D M J S D M J S D M J S D
1944 1945 1946 1947 1948 1949 1950 1951 1952 1953 1954

Fig. 2. Monthly mean values of noon E critical frequency, noon and midnight F_2 critical frequencies, and noon and midnight F_2 m.u.f.s over the sunspot cycle.

very small. The value of the 1954 minimum appears to have been lower than that at the 1944 minimum.

The dotted curves of Fig. 1 are from the monthly ionospheric data obtained at the D.S.I.R. ionospheric station at Slough. They are twelve-month running averages of the monthly mean noon and midnight critical frequencies of the F_2 layer, the critical frequency being the highest frequency returned from the layer at vertical incidence. By taking twelve-month running means the large seasonal variations of critical frequency are smoothed out, and the variations due to the changing sunspot activity become more evident.

The object in presenting these curves is to show how the changing sunspot activity affects the frequencies which the ionosphere is capable of reflecting, directly at vertical incidence, and thus by implication, at oblique incidence, as in practical radio communication over a distance. For a variation in the critical frequency at vertical incidence means a corresponding variation in the maximum usable frequency (m.u.f.) for transmission over any given distance.

Both noon and midnight critical frequencies are seen to have followed the variations in the sunspot activity, on this general basis, fairly closely. The noon critical frequency increase with increasing sunspot number was fairly constant until a sunspot number of about 100 was reached, but for higher values of sunspot number the actual frequency increase was less steep, as if a saturation effect in the ionosphere were occurring. It is seen, however, that the general critical frequency variation between sunspot minima and the maximum was of the order of 100% for both noon and midnight, being about 5 Mc/s in the former case and about 3 Mc/s in the latter. The m.u.f.s for short-wave communication would of course undergo corresponding but greater variations than the above, at noon and midnight respectively.

Fig. 1 does show, therefore, how closely the *general* ionospheric conditions at Slough followed the *general* level of solar activity, as indicated by sunspot observations. If we were to look at the ionospheric measurements from other ionospheric stations throughout the world we should see the same trends, though the actual values of critical frequency would be different. We now turn to a more detailed examination of the ionospheric variations, again based on the measurements made at Slough.

Month-by-Month Variations:—In Fig. 2 are plotted, as full lines, the monthly values of the Slough critical frequencies for the F_2 layer (f^0 F_2) for noon and midnight for the whole period covered by the sunspot cycle. The dot-dashed curve shows the monthly values of the critical frequency of the E layer (f^0E) for noon.

We may dismiss the latter curve at once by saying that the E layer variations over the sunspot cycle, whilst not without significance, are relatively small. The peaks and troughs in the F_2 layer curves are due to the seasonal variations in critical frequency, which, at noon, are such as to produce low values in midsummer and high values around midwinter, and, at midnight, high values at midsummer and low values at midwinter. This type of variation is now well established, being due, of course, to the variations in the relative position of sun and earth with the seasons..

Superimposed on these seasonal variations, how-

ever, there is an evident long-period variation which is that due to the sunspot cycle, the highest values of both noon and midnight critical frequency occurring near sunspot maximum and the lowest near sunspot minimum. It is regretted that, owing to space considerations, these values have had to be plotted on a rather small scale, so that the variations due to the sunspot cycle are less noticeable than would have been desirable. However, if we examine the dotted curves of Fig. 2 we can see the effect of the cycle upon practical short-wave transmission quite clearly. These dotted curves show the monthly values of F_2 layer m.u.f. for 4,000 kms (the maximum possible distance for one hop), as calculated from the Slough monthly critical frequencies, for noon and midnight respectively. That is to say, they give the monthly values of m.u.f. for a one-hop transmission path, with the F_2 layer over Slough as the apex of the trajectory.

The peculiarities of these curves are rather interesting. At noon in summer the m.u.f. increased between the minima and the maximum from about 16 Mc/s to about 23 Mc/s or by approximately 44%, and in winter from about 22 Mc/s to about 43 Mc/s or approximately 95%. The midnight m.u.f., on the other hand, increased from about 12 Mc/s to 21 Mc/s or 71% in summer, but only from about 8 Mc/s to about 9 Mc/s or 12% in winter. Thus the effect of the sunspot cycle was to increase enormously the m.u.f.s during the winter day, to do so to a lesser extent during the summer night, to an even smaller extent during the summer day and to cause hardly a variation at all during the winter night.

A few words about the reasons for these variations may not be out of place. The sun's effect upon the inosphere at night is an indirect one and thus the variations due to its changing activity would not be so great as during the day. During the deep winter night—when the direct effect of the sun has been removed for so long—they seem almost to disappear altogether, whereas during the summer night—with little darkness—they are still quite apparent. During the day the sun's effect upon the F_2 layer is not a simple one, for its behaviour is anomalous, in that during the summer the increase in the ionizing power of the sun's rays is more than counteracted by an expansion effect, so that the ionization per unit volume actually decreases, and the critical frequency falls, as compared with the winter. Thus the greatest effect of the changing solar activity occurs during the winter day, and is not so apparent in summer.

But we are, perhaps, more interested in the practical effects of these variations upon short-wave communication and it is interesting to note, from the dotted curves, the changing utility of various frequencies throughout the cycle. In doing this we should remember that we are studying curves for the ionosphere above Slough only, and that for practical purposes the usable frequencies will be much modified by conditions in other parts of the world.

Taking the daytime curves first, the most striking feature is the very high frequencies which would seem to have been usable for long-distance communications during the winter months around the maximum. In fact, the curves indicate that frequencies above 30 Mc/s could have been used during 4 winters, though it is doubtful whether such frequencies were, in fact, put to much use for this purpose. A frequency of 28 Mc/s, it is seen, should have been usable during 6 out of the 11 winter periods, whilst a frequency of 21 Mc/s should have been usable winter and summer alike from 1946 to 1950 inclusive, and to have been too high during the summer periods only of the remaining years. A frequency of 15 Mc/s would have been used throughout the year during the years near the sunspot minimum, but would probably have been too low for years around the maximum. Of course, the daily *periods* of usefulness of different frequencies are not apparent from these curves and would vary from year to year.

The midnight curves indicate that 15 Mc/s would have been usable at night during 6 of the summer periods and 11 Mc/s during the remainder. As to the most suitable frequency for winter night-time use the indications are that 7 Mc/s should have been usable throughout the cycle, and would not need alteration from minimum to maximum. Again it is stressed that some modifications to the above conclusions would be necessary when full account is taken of the actual transmission paths, and of other periods of the night. However, the curves do give us a general indication of the utility of different frequencies, both for daytime and night-time use.

The New Cycle:—So much for the old cycle. We learn what we can from the ionospheric measurements taken during its course. But we now desire to know something about the new one, and particularly about how radio conditions are likely to change in the immediate future. Unfortunately, it is here that we are at a loss. For the laws which govern sunspot cycles are not yet known and we are very much in the dark as to how the sunspot activity will vary in the near future. If we only knew that we could well relate our knowledge of radio conditions to it and say how they would most likely change. But we do not know it and so can only speculate, at least for a year or so to come.

For 1955, therefore, it is impossible to forecast what changes may occur. If the new cycle has well begun the sunspot activity may increase somewhat more rapidly than it has been decreasing during the past year. We say this merely because it has *usually* done so in the year following past minima of which there are records. But it seems unlikely that, by the end of the year, it will have reached a value such as to have produced any large variations in the ionosphere, and to have made any very significant changes to the frequencies at present most useful for short-wave communication.

"I see commercial television is here!"

Build your own MODERN

5-CHANNEL large screen TV

The MAGNAVIEW receiver, incorporating the latest techniques, gives excellent performance and its large-screen, flat-faced, aluminium-backed Brimar Teletube gives extra bright pictures.

EASY to BUILD

and reduces home construction to the simplest possible proportions. Anyone with previous experience in the construction of radio receivers, and an elementary knowledge of the principles of TV circuitry, can build it.

Ask for this booklet

—Its popularity has necessitated the issue of a

THIRD EDITION

A number of circuit modifications have been introduced to give improved performance. The text has been re-written and new drawings and photographs have been prepared. The first step towards building this outstandingly modern TV Receiver is to fill in the application form and post it NOW.

BRIMAR
VALVES and TELETUBES

Please send me constructional details for the LARGE SCREEN TV. I enclose 6d. Postal Order to cover packing and postage.

NAME .....

ADDRESS .....

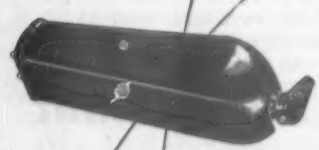
.....

.....

Standard Telephones and Cables Limited **FOOTSCRAY, SIDCUP, KENT**

Longer Life

for LONG PLAYING RECORDS



acos Hi-g

Recording techniques have made such strides over the last two years that if you are to get the really superb reproduction made possible by the latest L.P. records . you need one of the Acos "Hi-g" Pick-ups. These have been specially designed to meet the very exacting demands of the new records with their shallow groove and microscopic sound "track". This special design is necessary on two scores — firstly to do justice to the brilliant recording, and secondly to ensure the longest possible life from L.P. records. Such records are expensive; even a single playing with an unsuitable pick-up can cause irreparable harm.

If you want the best reproduction and value from *your* radiogram or record player and L.P. records ask your dealer *(or post the coupon below)* for details of the "plug-in" ACOS "Hi-g" Pick-ups — specially designed to replace existing pick-ups on most famous makes of record playing equipment. The cost? **32/6d. (plus 10/5d. P.T.)**

ACOS devices are protected by patents, patent applications and registered designs in Great Britain and abroad.

... always well ahead

To: COSMOCORD LIMITED, ENFIELD, MIDDLESEX.

Please send me details of ACOS "Hi-g" replacement pick-up heads

NAME .....

ADDRESS .....

.....

WW

* **NUMBER PLEASE!**
The new restricted form of London Telephone Directory no longer includes subscribers, like Cosmocord, in "fringe" areas. Please note therefore that our number is **ENFIELD 4032.**

SIMPLE WAVE-SHAPER

Giving Square-wave Output from Sine-wave Inputs from 100 to 5,000 c/s

By ARTHUR W. WAYNE*

WHILE spot-frequency square-wave generators are useful for general amplifier testing, a continuously variable source is often of value for detailed investigations; for example, of tone control circuits at various settings.

Many types of shaping circuits are available, each with its own particular limitations. The multivibrator is suitable only for spot frequencies, unless accurately matched tandem gain controls are available; and such components are both expensive and difficult to obtain within the required tolerance. Further, the wave shape is unsatisfactory unless passed through a clipper stage, thus adding cost and complication. The transitron circuit is again capable only of spot frequencies, and is apt to be difficult in regard to its power supply. The cathode-coupled clipper is critical of circuit layout, and is better followed by a further clipping stage, while the tetrode limiter needs heavy driving, and does not always produce a satisfactory waveform unless the output be subjected to further clipping.

In fact, all these circuits are at their best only when followed by clippers, and with this in mind, it was decided to make do with a clipper alone, and so arrange the circuit that deficiencies in the clipper could be easily compensated elsewhere. Fortunately, several sine-wave generators were available, so lack of self-contained excitation was not a serious matter. The arrangement finally adopted was that of Fig. 1, and it proved so satisfactory for its purpose that it is now in production for commercial use.

The circuit is almost self-explanatory, but one or two points are perhaps worthy of comment. In order to keep the clipper independent of external conditions, it was necessary to couple it to the output by a cathode follower; and as a position for this stage had to be provided on the chassis, and only double triodes were immediately available, one half of an ECC33 was used for this purpose, and advantage was taken of the other half to provide an input amplifier.

V2a is an overdriven triode, with component values chosen for very sharp clipping. Operated with zero bias and a very low anode load, excessive grid excitation quickly drives the valve into both the anode bend and saturation regions of the characteristic. V2a is directly coupled to V2b, the grid of V2b being held negative to its cathode by the voltage drop across R_7. C_4 with R, form a high-pass filter to help compensate circuit strays and other deficiencies.

Variable Time-Constant

The output from V2b is coupled to VIb via C_3 and VR_1, and in operation the full value of VR_1 is used for the lower frequencies, but is reduced from 3,000 c/s upwards, until at 5,000 c/s only about 25,000 ohms are left in circuit. Unless this reduction in time-constant be made, rounding of the corners occurs at the higher frequencies. When a square-wave is passed through a

* Shirley Laboratories, Ltd.

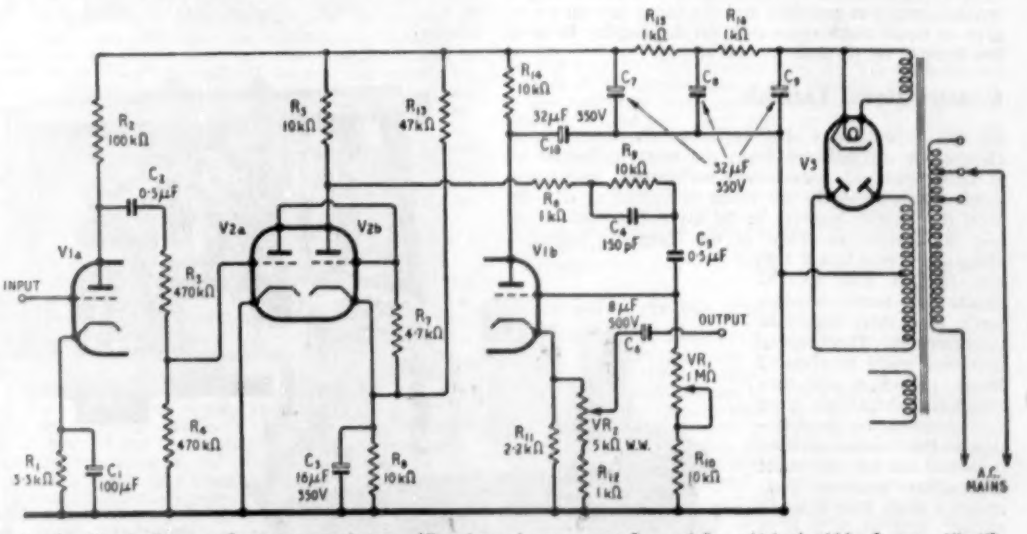


Fig. 1. Circuit diagram of square-wave shaper. All resistors 1-watt except R_{15} and R_{16} which should be 5-watt. V1, V2, ECC33 or ECC82; V3, GZ30 or EZ80.

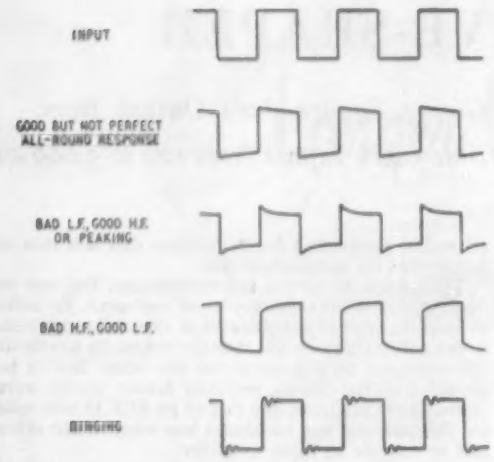


Fig. 2. Typical square-wave distortions and some of the amplifier deficiencies which cause them.

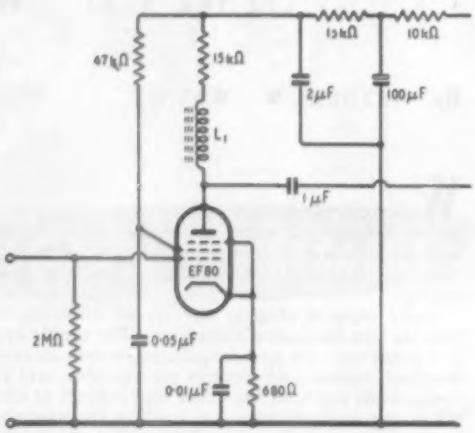


Fig. 3. Wide-band oscilloscope amplifier. A long-wave, dust-cored coil is suitable for L_1.

differentiating circuit, as the time-constant is reduced the waveform distorts, the leading edge rising and the trailing edge falling. Advantage is taken of this to compensate for the integrating action of the strays in conjunction with the circuit resistances. While this, admittedly, is a brute-force-and-ignorance method of obtaining results, it does work quite effectively, so *non olet*.

A sine-wave input to the shaper of 4 V r.m.s. is sufficient to ensure satisfactory operation, but some reduction may be necessary from 3,000 c/s upwards. Although a good shape may be obtained from as much as 20 V r.m.s. at 100 c/s, it will be found that between 2 and 6 V r.m.s. is all that can be handled in the higher ranges. In practice, VR_1 is adjusted to give as sharp a leading corner as possible, and the input is then set to give an equal mark-space ratio on the display. It takes less time to set up than to read about.

Constructional Latitude

Circuit layout may be anything the constructor chooses or can achieve, from the worst rat's-nest to a highly finished commercial instrument, and component tolerances do not seem to matter at all. In fact, the shaper appears to be quite unconscious of any deficiencies in either of the foregoing respects, although it was found that the ECC33 and ECC82 functioned more satisfactorily than their American counterparts. The original unit was made in about 3 hours, including post-constructional alterations, from first commencing the drawings to the finished article: it should not take the most meticulous amateur constructor more than 4 hours or so. And while it is in no way a laboratory instrument, being designed only for the limited function and coverage described earlier, it does in fact produce a sufficiently satisfactory approximation to a square-wave, from as low as 20 c/s to well above 10,000 c/s.

For the benefit of those who are not accustomed to square-wave testing of amplifiers, a few characteristic displays are given in Fig. 2. Much information can be gained from observing on the oscilloscope screen the effects of deliberately altering the values of circuit components in the amplifier being tested.

Finally, it must be stressed that, when making square-wave tests, the oscilloscope amplifiers must be above suspicion. Not all commercial instruments meet with this requirement, and for those who are doubtful, a circuit for a wide-band amplifier is given in Fig. 3. Power supplies may be taken from the shaper.

Commercial version of the wave shaper made by Shirley Laboratories, Ltd., Worthing.

LETTERS TO THE EDITOR

The Editor does not necessarily endorse the opinions expressed by correspondents

Tape Machines

I SUPPORT Harry Crampin's plea (your December, 1954, issue) for higher tape speeds and larger spools. I also agree that the European standard spool (single-cheeked) is preferable to the U.S. and for the following reasons:—

One should aim at uniform tape tension on both sides of the gate, because failure to vary the torque with the radius gives an additive error. In other words, without radius compensation on either side, at the time when the tape is being least assisted from the gate by the take-up spool it is also being most heavily impeded on its journey towards the gate by the higher speed at which the reservoir spool has to rotate. As is well known, the simplest and most reliable way of minimizing both these discrepancies is to employ gravity clutches whose slip varies directly with friction and therefore with the loading, but it is perhaps not always realized that unless the "weight ratio" equals the "diameter ratio" compensation is not achieved. A European standard spool weighs 29oz loaded and 8½oz empty, a ratio of 3.3. Similarly, the effective outer diameter is 11in against the core diameter of 3½in, again a ratio of 3.3, but on no other design of spool has this been so carefully looked after, certainly not on the U.S. which is also much harder to adapt to the domestic 7in centre and vice versa. The demands for larger spools will not diminish the popularity of smaller ones.

A third advantage concerns track discrepancy. On multi-track machines it is of course possible, with double-cheeked spools, to re-play on a different head simply by turning the spool over, but unless the machine is in perfect alignment this will result in loss of top. Such a procedure is impossible with single-sided spools, each track always having to be replayed from the head through which it was recorded. Also the European standard spool is much easier to thread, join and edit and there is less chance of noise from the tape catching on the cheek of a spool.

Last but not least, the capacity is larger and in view of these many advantages I deplore the present tendency for the U.S. standard to oust the European. Reverting to Mr. Crampin's preference for Continental designs, I would stipulate that in addition to being self-reversing it should be in order to switch off the machine merely by breaking the mains connection. Any form of remote control is out of the question with most British designs as the pressure roller would be left in static contact with the capstan, which the makers strongly deprecate. Could one of the rubber or synthetic rubber manufacturers please state whether too much fuss is not being made over static contacts on pressure rollers, at any rate so far as machines in daily use are concerned?

Cleethorpes, Lincs. R. LEACH.

YOUR correspondent's specification (December, 1954, issue) for an ideal tape recorder reminds me of an R.C.A. wire recorder I had several years ago. This machine was magazine loading like a cine camera, each magazine holding two wires of ½hr duration each and so arranged that as one was playing the other was rewinding.

The wires were driven at a constant speed by capstans, and a very ingenious spring arrangement between the reels not only kept the wires taut, but also transferred the rotation of the supply reel to the take-up with the necessary compensation for wire build-up. At the end of a reel a notch in a rotating disc (which also served as a footage indicator) tripped over a switch within the machine and reversed the direction of the driving motor and the amplifier connection to the sound heads.

In spite of a bakelite case and 5-in speaker the good design and precision of the mechanism gave a quality and freedom from "wow" seldom obtained with the average popular-priced tape machine.

Doncaster. P. STUART.

Variable High-pass Filters

THE use of variable steep-cutting *low*-pass filters in domestic high-fidelity amplifiers has become almost standard practice. It is therefore surprising that the use of variable steep-cutting *high*-pass filters (not fixed rumble filters) appears to be relatively rare. Such a filter is of considerable value in minimizing listener fatigue due to distracting effects associated with the low-frequency end of the spectrum, and only too apparent in reproducers having speaker systems capable of extended bass response.

The immediately apparent advantages of a high-pass filter are:—

1. Reduction of hum and rumble inherent in many discs, particularly of the l.p. type. This may readily be verified by playing different discs on a high-quality turntable and noting the disc-to-disc variation in reproduced hum and rumble.

2. Reduction of severe non-linearity distortion due to random "cone flutter" in woofers used with amplifiers having useful response down to 2-5 c/s.

3. Reduction of modulation and other hum sometimes presented free of charge in radiated radio programmes.

The preceding advantages are to some extent obtainable from the usual fixed rumble filter. An advantage peculiar to a *variable* high-pass filter is that it will, in conjunction with the commoner low-pass filter, provide ready adjustment of "frequency-range balance." It is well known that when for some reason the h.f. response has been sharply curtailed it is often necessary to curtail the l.f. response as well in order to maintain an aesthetically pleasant tonal balance. A suitable product for the l.f. and h.f. cut-off frequencies is generally given as 500,000. On this basis the respective nominal cut-off frequencies for two 5-step filters could, for example, be: (a) Filters out (say 25-20,000 c/s); (b) 40-13,000 c/s; (c) 50-10,000 c/s; (d) 70-7,000 c/s; (e) 100-5,000 c/s.

The "straight-line" fanatic will probably pale at or beyond step (b). Nevertheless, step (e) will allow enjoyment from a treasured acoustically recorded disc.

The high-pass filter can conveniently be of the R-C parallel-T feedback loop type outlined by Thiessen (*J. Acous. Soc. Amer.*, Vol. 16, No. 4, April, 1945). If an existing pre-amplifier cannot painlessly be modified to this extent, reasonable results can be had by using a multi-pole switch and several cascaded elementary R-C filters. The latter alternative may in fact find favour with those who look with suspicion on sharp knees in filter curves.

Pretoria, S.A. M. R. H. MACNAMARA.

Electronics on the Farm

IT seems to me to be about time that the electronics industry and the farm machinery industry got together on the subject of electric fencer units.

The basic electric fencer, by now a hoary old stager, is a six-volt battery (usually an old car accumulator) feeding a balance wheel interrupter and thence a transformer, to inject spurts of negligible power but about 10 kilovolts into a fence wire which is carried on insulators.

Since the power demand is extremely low, the chief disadvantages of the accumulator become very obvious. Accordingly several manufacturers have produced models designed to run off the ubiquitous radio h.t. battery. As far as I know most of these have also been modified in the interrupter mechanism; but if I am any judge of the

contents of a sealed box, and the clicks it produces, the interrupter is still a moving contactor. It is true that the improvements in the interrupter mechanism are probably considerable, for salesmen talk glibly of a five-year guarantee; indeed, I suspect that the timebase is a resistance-capacitor circuit and the contactor a reasonably good magnetic relay. However, I submit that for this purpose a neon tube would be far cheaper and more reliable, and that a wholly electronic unit would be superior to any unit containing mechanism.

I admit that I lack complete technical information. It is possible that I am mistaken in believing that a reasonable neon tube will effectively act as a switch and/or carry the power demand, and I suggest that the matter might well be worth examination.

The advantages which I foresee are cheapness and simplicity in first cost and maintenance, lightness and compactness. The neon tube would certainly plug in, presumably the electrolytic capacitor could also be plugged and, although perhaps unusual, the resistor as well. The transformer hardly ever gives any trouble, and therefore maintenance would consist of nothing more than buying a new relatively inexpensive unit and changing it for the old one. It is true that the older farmer might not know which to change, but that idea is becoming out of date.

Another refinement I have yet to meet, except on my own fencers, is a neon earth detector on the h.t. side. I have de-capped miniature Philips neon lamps and connected them across the output terminals ($\frac{1}{2}$ megohm in series) so that they flash if the fence wire is *not* earthed. Few stockmen will shock themselves to find out if the fence is in fact working, and I suspect that our cattle would be "out" a good deal more often without this aid.

It appears that present fencers usually have a frequency of about two flashes per second. My present balance wheel units suffer far too much from burnt contacts, and therefore when I overhauled them this last spring I reduced the frequency to about one per second, thereby in effect doubling the working life. So far I have found no disadvantage.

My units, being expensive of their kind, carry a simple, but not nasty, battery voltage indicator with a push-button switch. It is perhaps because the h.t. battery type is alleged to run for five months on one battery that this refinement is invariably omitted. It is not easy to justify a moderately expensive unit which will not be used above twice a year, but I submit that a push-button, a resistance, and a torch type bulb might serve; with instructions that the bulb should be held on for a few moments and will fade rapidly on a worn-out battery.

Hempstead, Essex. H. G. P. TAYLOR.

Mathematics

HAVING been cited in the January issue by F. V. Bale as an example of the type of writer who lowers the tone of *Wireless World* by frightening readers off mathematics, may I be allowed to reply?

If indeed I have been guilty of discouraging anybody from the study of mathematics, then I deserve censure. So far from my intention having been that, however, it has been precisely the opposite; namely, to debunk the supposed esoteric nature of mathematics and to break down the mathematicians' "closed shop." In the very article which Mr. Bale quotes I showed how the basic filter equations could be arrived at by schoolboy algebra, and then, having taken the reader to the desired point by presumably familiar ways, revealed the cosh as nothing to be afraid of but rather as a useful tool—"The practical value of the cosh, then, lies in the fact that it enables one to dodge most of the work by looking up tables.... Anybody can do that."

It surely cannot be denied that there are thousands of potential technicians and engineers who do find hyperbolic functions in the abstract a forbidding and largely meaningless subject, and their relationship to filters far from obvious. The above-quoted article being the example chosen by Mr. Bale to deplore, what alternative treatment does he recommend for these readers?

At the other extreme, my own experience as a wartime radar instructor showed me that graduates in mathematics were not automatically able to apply it to practical uses; most of them had never clearly visualized the physical realities represented by their equations. These, too, surely stand to benefit from an alternative approach.

A crime to which I do quite cheerfully plead guilty is that of lack of respect for the type of author who fills his pages with mathematics and considers it beneath his dignity to explain what it means in words. In this attitude I am glad to be in the company of perhaps the most noted authority on the presentation of technical information—Prof. R. O. Kapp, whose concluding paragraphs in his paper "The First Draft"* should be taken to heart by the over-mathematical. "CATHODE RAY."

* Obtainable from the Secretary of the P.T.I. Group, University College, London, W.C.1. price 2s.

Viewers' Strike?

LIVING on a main road within a few yards of the junction with another main road and receiving a weak signal from the Brighton booster and a still weaker one from the new Rowridge station, I am finding out some things about ignition interference.

Of all the cars passing my door, 90 per cent are unsuppressed and even some of the new cars have either unsatisfactory suppressors or the suppressors have been removed.

It is time that the P.M.G. made the fitting of suppressors to cars compulsory, even if it means supplying the suppressors free. The cost of this could be met from the percentage of broadcast licence fees retained by the G.P.O. If all licence holders got together and refused to renew their licences, I am sure a speedy solution would be found.

Worthing, Sussex. W. E. NIALL.

Tape Terms

A LANGUAGE of magnetic tape recording is evolving and, although standardization is yet a toddler as regards technique, some unhappy selections are emerging in the language and seem to have become accepted as standard terms already.

It helps so much to link meaning with function, rather than to blind with slick startlers, that one hopes terms such as "azimuth" will not prevail.

When technicians use that term, the context usually suggests that they mean "head" tilt relative to tape path. "Azimuth" is an ancient astronomical term of different meaning, shortly put as "an arc of the horizon." This is borne out by its origin: Arabic *al* (the) *sumut* (direction). How does it come to be used to suggest a different meaning for which a better word exists, namely, "oblique"; Latin *ob* (before) *liquis* (slanting) defined shortly as "to deviate from the perpendicular?" That, surely, is exactly what is meant.

Bristol Magnetic Recorder Company,
Bristol, 3. W. D. ARNOT.

Overseas Buyers

FREQUENTLY an article advertised in *Wireless World* attracts my attention and I develop an urge to buy it. But I get disturbed about foreign exchange, extra postage for overseas mailing, etc., and I finally decide the product is perhaps not worth all the fuss anyway.

Perhaps this is wrong. Could not your advertisers publish a little bit on how receptive they are to small foreign orders and how to go about it, especially extra payment requirements for overseas mailing?

Yonkers, N.Y., U.S.A. MARTIN L. KENELY.

"BELLING-LEE" NOTES

These notes have been contributed by our senior research engineer, and introduce a very interesting basis of comparison for aerials, and can, of course, be applied to aerials of any manufacture.

Goodness Factor For Aerials

It has been often stated that aerials for use in fringe areas should have the maximum possible forward gain, thus ensuring that as much signal as possible is available at the receiver. This is undoubtedly the condition required for reception in areas where local interference can be ignored, and where the signal is limited by the noise generated in the receiver itself.

In some areas the picture is marred by local interference, by motor cars, etc., while in others an otherwise perfect picture is spoilt by ghost reflections. In both these cases the directional characteristic of the aerial is important. This is the property of the aerial which enables it to distinguish between the wanted and unwanted signals.

If we now consider the fringe area in which interference is present, we are faced with a problem of how to describe an aerial as neither the forward gain nor the polar diagram give a complete picture of its performance. A Goodness Factor can, however, be defined, but the validity of this Factor can only be tested by practical observation of pictures under a wide range of conditions. We are considering the use of Goodness Factor F, defined by the equation $F = \frac{V}{A}$ where V is the voltage gain of the aerial relative to a half-wave dipole and A is the total area under the polar diagram, assuming the area under a dipole polar diagram, to be unity, and the amplitude of the diagram in the forward direction to be the same for all areas.

It can now be seen that F includes both the forward gain and the directional characteristics of the aerial and increase in either of these is improved. As an example the Goodness Factor of various "Belling-Lee" aerials is as follows.

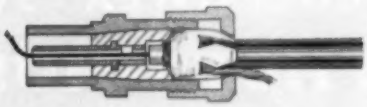
BROADSIDE—3 element array.	**5.2**
Junior Mult.	**3.3**
Senior H	**2.5**
Junior H	**2.7**
Kayrod	**2.3**
Dipole	**1.0**

Advertisement of
BELLING & LEE LTD.
Great Cambridge Rd., Enfield, Middx.
Written 14th December 1954

A UNIVERSAL LOADING PLUG

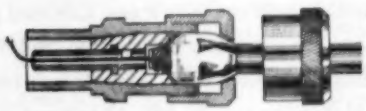
Tip or back solder or crimp-as you please . . .

Tip soldered with braid as pigtail through collet and nut



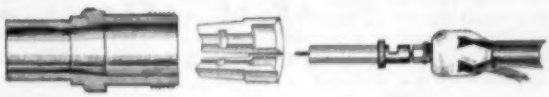
CLAMPING NUT ONLY REMOVED FROM BODY HOUSING

Tip soldered with braid bunched up against collet



CLAMPING NUT AND COLLET ONLY REMOVED FROM BODY HOUSING

Back soldered with braid as pigtail or bunched



or crimped

● We have now modified out L.1329 coaxial plug to include a hole through the length of the pin so that this can be tip soldered as an alternative to back soldering or crimping. In view of the marked preference for tip soldering, we have also re-instated our all-metal L.734/P coaxial plug.

These two types will now be interchangeable, and by supplying both types we believe we have met most needs that can arise, particularly the requirements both of those who prefer to load the plug without completely dismantling it, and those who dismantle the plug completely before soldering. Both plugs are also suitable for use as a temporary connection, without either crimping or soldering, but this is very bad practice.

BELLING & LEE LTD
GREAT CAMBRIDGE RD., ENFIELD, MIDDX., ENGLAND

a new STABILISED POWER SUPPLY UNIT FOR PHOTO-MULTIPLIERS

Ediswan now have available a new stabilised power supply unit which has been specially designed to feed Photo-Multipliers. It is particularly suitable as a supply unit for Ediswan Mazda Photo-Multipliers type 27.M1, 27.M2 and 27.M3.

BRIEF SPECIFICATION

INPUT	OUTPUT	STABILITY	OUTPUT RESISTANCE	RIPPLE
200 – 250 v., 40 – 100 c.p.s.	High stability low ripple D.C. supply variable between 300 and 1,100 volts. Max. current 2 mA. Pos. or neg. may be earthed.	A 10% change in mains input voltage results in a change of less than 0.1% between 1,100 volts and 600 volts output.	Approximately 1,500 ohms.	Less than 0.01% R.M.S.

MOUNTING The Unit is suitable for standard rack mounting or for bench use. Bench Stands are available.

PRICE — £48

Further information is available on request

EDISWAN

RADIO DIVISION · THE EDISON SWAN ELECTRIC COMPANY LIMITED
155 Charing Cross Road, London, W.C.2. *Telephone:* Gerrard 8660. *Telegrams:* Ediswan, Westcent, London
Member of the A.E.I. Group of Companies

SP118

Vector Addition and the Slide Rule

Rapid Method of Calculation

By A. G. LONDON, B.Sc.(Eng.), Graduate I.E.E.

A GREAT many calculations in electronics involve working out the value of terms of the form

$$\sqrt{(x^2 + y^2)}.$$

Two examples which come readily to mind are:

(i) The magnitude of the resultant of two vectors, V_1 and V_2, at right angles, is given by:

$$\sqrt{(V_1^2 + V_2^2)}$$

(ii) The magnitude of the impedance of a series-tuned circuit is given by:

$$|Z| = \sqrt{[R^2 + (\omega L - 1/\omega C)^2]}$$

The usual method of calculating the value of a term of this form is to find the squares separately, add them, and find the root again. This is a rather tedious business, particularly if it has to be repeated a number of times. A much quicker and easier method exists, however, which eliminates those little addition sums, done on odd scraps of paper. The whole process can be carried out on a slide rule without "taking off" any figure except the answer. The slide rule can be of the simplest type, one with only the four main scales.

A reminder of the properties of these scales may not be out of place. They are usually called scales A, B, C and D, from top to bottom, A and D being on the stock; B and C on the slide. They are so arranged that if the cursor is set to a number on scale D the square of that number appears under the cursor on scale A. Square roots are found by the reverse process. Scales C and B, respectively, have similar properties.

Now suppose we wish to find the value of the root $\sqrt{(x^2 + y^2)}$, y being smaller than x, we proceed as follows.

1. Set the slide rule so that y on scale C is opposite x on scale D. (Arrow 1 on Fig. 1.) Then by the ordinary rule for division, x/y will appear on scale D, opposite the end mark on C. (Arrow 2 on Fig. 1.)

2. Set the cursor to the end mark on scale C. Then, as we have already noted, $(x/y)^2$ will appear under the cursor on scale A. (Arrow 3 on Fig. 1.)

3. To the value of $(x/y)^2$, add 1, and set the cursor to this new figure, still on scale A. (Arrow 4 on Figs. 1 and 2). The cursor now indicates $(x/y)^2 + 1$ on A; and the square root of this on scale D. (Arrow 5 on Fig. 2.)

4. Now move the slide until the end mark on scale C is set against the cursor.

5. Read $\sqrt{(x^2 + y^2)}$ on scale D opposite y on scale C. (Arrow 6 on Fig. 2.) In steps 4 and 5 we have used the ordinary multiplication rule to multiply $\sqrt{[(x/y)^2 + 1]}$ by y, and,

$$y\sqrt{[(x/y)^2 + 1]} = \sqrt{(y^2[(x^2/y^2) + 1]} = \sqrt{(x^2 + y^2)}$$

In the example shown in the figures, $x = 4$, $y = 3$. Then the successive steps are:

1. $x/y = 1.333$
2. $(x/y)^2 = 1.78$
3. $(x/y)^2 + 1 = 2.78$
4. $\sqrt{[(x/y)^2 + 1]} = 1.667$
5. $\sqrt{(x^2 + y^2)} = 5$

It is important, in step 3, to keep in mind the position of the decimal point in $(x/y)^2$. In the example, the figure 1.78 on scale A actually represents this number, and $(x/y)^2 + 1 = 2.78$. However, according to the relation between x and y, it might represent 1.78 multiplied by any power of 10; e.g., 0.178 or 17.8. Then $(x/y)^2 + 1$ would be 1.178 or 18.8 respectively. Care is therefore necessary at this point in the operation.

The process can very simply be adapted to evaluate a root of the form $\sqrt{(x^2 - y^2)}$. The only change necessary is that, in step 3, 1 is subtracted from $(x/y)^2$, instead of being added, and the cursor is set to this value; i.e., $(x/y)^2 - 1$. The square root is then taken as before, multiplied by y, and the answer read on scale D. The proof is exactly analagous to the case of $\sqrt{(x^2 + y^2)}$. Clearly, this comes in useful, for example, in the series-tuned circuit case mentioned above, if we know the impedance, but the resistance or the reactance is unknown.

$$\text{Then } R = \sqrt{(|Z|^2 - X^2)}$$

While no claim is made that the process described in this article is original, it is a simple and rapid method of solving the particular problem, and deserves to be more widely known. Many readers will, no doubt, be able to find other applications besides those mentioned.

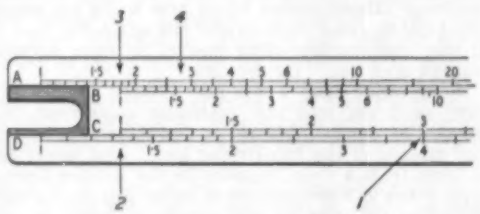


Fig. 1. The first steps in setting the slide rule are shown here, culminating in $1 + (x/y)^2$ at point 4.

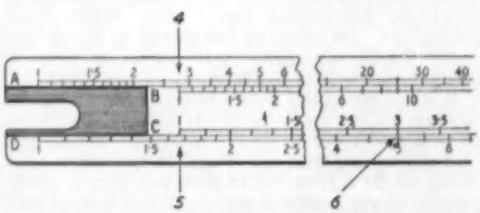


Fig. 2. The final steps are illustrated here; the root appears at point 5 opposite point 4 and multiplying by y gives the answer at point 6.

FLUX-CUTTING or FLUX-LINKING?

A Controversy on Fundamentals—and a Practical Solution

By "CATHODE RAY"

NOT very long ago there took place at the I.E.E. a discussion on fundamental electromagnetic theory*. At the end of it the chairman remarked that although it was the normal policy of the I.E.E. to encourage student members to attend its meetings, he was rather glad they hadn't been much in evidence on that particular occasion. Well, certainly, it did seem somewhat unedifying to hear one learned Professor of Electrical Engineering after another disagreeing flatly on the very basic principles of the subject. Quite enough to shake whatever faith students may have in the authorities, and to make one wonder whether there is anything—even Ohm's Law—that can be relied upon to be true.

One of the most discussed things on such occasions is the question of how to reckon induced e.m.f.—whether on a basis of "cutting magnetic lines of force" or some other way. Nearly all the electricity used in the world is generated by electromagnetic induction. And the process is fundamental in radio too, for radio waves would be impossible without it, and so would transformers, chokes and tuning coils. If then the most eminent authorities invariably disagree on the principles of the thing, how can anybody be expected to understand it and make the necessary calculations for designing radio and other electrical systems? Disagreement about how wages are calculated can be relied upon to give rise to trouble; how is it that disagreement about how to calculate induced voltage does not? Or does it?

Some while ago† I was rash enough to stick my own neck out into this particular controversy, by advocating the flux-linkage (or flux-threading) idea at the expense of the flux-cutting idea. And now I get a letter from a radio engineer in the Belgian Congo who writes in some concern to report that after gladly accepting my view on this matter, as being in line with that of his one-time professor of electricity, he was dumbfounded on being confronted by a junior colleague with a description of an actual electric generator that by its method of functioning absolutely proved the flux-cutting idea. More shaken faith, presumably! He may be interested to know that at the I.E.E. discussion this particular kind of generator was well in the forefront of the battle, and my shocked ears could hardly believe what they heard when one teacher made the highly immoral suggestion that students should be kept in ignorance of it because it did not square with the official curriculum.

Well, far be it from me to pose as a sort of super-authority to put everyone else right, but it does seem to me that at least some of this confusion is capable of being dispelled. First of all, for the sake of any readers who are not yet quite "with us," let me explain what the controversy exactly is. It began with Faraday's famous experiments in 1831. He found that an electric current could be magnetically induced in a circuit in two ways: (1) by moving a magnet near the circuit (or, what comes to the same thing, moving the circuit near a magnet); and (2) by moving neither but varying the strength of the magnetism, say by switching the current on and off in a coil of wire producing it. The first of these processes is applied in every rotary electric generator; the second in every transformer and tuning coil. Faraday visualized the magnetism as lines of force in the space around and within the magnet, and regarded the current in the first class of experiments as being induced by these lines cutting across the circuit (or the circuit cutting the lines). He was inclined to think that the results of the second class of experiments could be regarded in the same way, by supposing the lines of force to spring out of the coil as the current was increased, and so to cut across any coupled circuits.

Before generators and transformers could be designed on a proper engineering basis—and certainly before radio equipment could be designed—it was necessary to be precise about the relationship between movement or variation of magnetic field and the voltage of the e.m.f. generated thereby. The strength of a magnetic field can be reckoned by the force it exerts on a small magnet. It was agreed to suppose that a certain force corresponded to so many lines per square centimetre. The total number of lines over a given cross-section was called the flux. It was found that the e.m.f. generated in a circuit was proportional to the rate at which flux was cut by the circuit, or varied within it. In fact, when the amount of flux corresponding to a "line" had been defined, it turned out that in order to generate an e.m.f. of one volt it

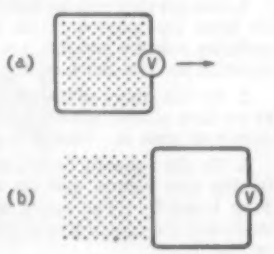


Fig. 1. Here is an idealized example of electromagnetic induction. The dots represent an end-on view of 10^8 magnetic "lines," uniformly distributed. The square circuit is supposed to move steadily from position (a) to position (b) in one second. What will the voltmeter V read during this process? And why?

* "A Short Modern Review of Fundamental Electromagnetic Theory," by P. Hammond, *Proc I.E.E.* Pt. I, July, 1954.

† *Wireless World*, June, 1953, p. 285 ("Radio Waves").

was necessary to vary the lines at the rate of 100,000,000 ($=10^8$) per second.

Now this is where we get to the controversy. Fig. 1 shows a simple circuit, consisting of a square of wire connected to a voltmeter. So as not to introduce complications caused by the magnetic field due to current in this circuit, let us suppose that the voltmeter has an infinitely high resistance, so that no current flows. The dots are end views of the lines of force produced by a coil not shown, but parallel to the single square turn. To avoid complications again, let us suppose that the return paths of these lines are kept well clear of our picture by means of a high-permeability iron core. Finally let us assume that notwithstanding the fewness of the dots there are actually 10^8 lines of force enclosed by the circuit, and that they are distributed uniformly over its area. If now the circuit were moved steadily to the right from position (a) to position (b) at such a speed as just to clear all the lines of force in one second, we can safely assume that during this process the instrument would read one volt.

But if you ask a number of engineers to explain this result you will discover two schools of thought. Some will say that three of the four sides of the circuit take no part in the experiment because they cut no lines of force, but that the fourth—the left-hand one—was cutting 10^8 lines per second, and that was why an e.m.f. of 1V was generated. Others will say that at the beginning of the operation 10^8 lines of force were linked with the circuit, and at the end none were; difference, 10^8; so magnetic linkages with the circuit were being varied at the rate of 10^8 per second, and that was why an e.m.f. of 1V was generated.

Divided Counsels

Precisely the same result and explanations are forthcoming if the circuit is kept stationary and the field is moved to the left. And precisely the same result is obtained if both are kept stationary and the current in the unseen magnet coil is reduced at such a rate as to bring the field steadily to zero in one second—but this time the explanations will vary. The line-cutting school of thought splits into two: one group will say that of course this is quite a different effect, so cannot be expected to have the same cause; the others stick faithfully to the cutting idea, and adapt it to cover the changed circumstances by saying that the lines can't just come from nowhere, but that when current in the magnet coil is increased or decreased they spring out or flop back, so cutting the circuit and generating an e.m.f. one way or the other around it. This adaptation of the original line-cutting picture may perhaps be accepted, provided that nothing better can be found and that it is consistent with other known facts. But slightly more elaborate experiments show that an e.m.f. is induced in a circuit by growth or collapse of a magnetic field *even when that field is caused by current in that same circuit*, and I for one find it a little difficult and unconvincing to visualize a wire being "cut" by lines of force emerging from itself.

When we come to interrogate the linkage school of thought we find them perfectly happy and pleased with themselves, because their account of the previous (Fig. 1) experiment equally well covers the current-varying or transformer experiment, without involving them in having to explain where the lines come from or where they go. Whether the number of lines

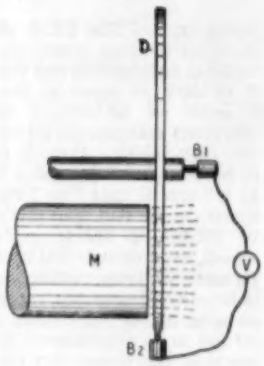


Fig. 2. D is an edge view of a metal disk, rotating in the field of a fixed magnet M. B1 and B2 are brushes making electrical contact with axle and edge of disk. Will the voltmeter V give a reading? If so, why?

linked with the circuit is made to change by moving the field or circuit or both, or by varying the strength of field in a stationary set-up, makes no difference to the e.m.f. induced; so why, they say, adopt an explanation that has to be forced to fit some of the facts, or alternatively use two explanations to cover facts that are obviously related and can perfectly well be covered by one?

This is the psychological moment, when these linkage people are swelling with self-satisfaction, to perform the experiment known as the Faraday disk or the homopolar generator. One form of it is shown in Fig. 2. D. is an edgewise view of a copper disk which is rotated steadily. B1 is a brush making contact with its axle, and B2 is another making contact at its rim. M is a fixed magnet arranged so that its lines of force pass through the disk, and the whole circuit is arranged so that no lines link with it. Therefore, according to the linkage school of thought, no e.m.f. can possibly be induced by turning the disk. But unfortunately for them the meter shows that it is. The thing with which my Belgian correspondent was confronted, although different in form, was obviously identical in principle, and was no mere theory or experiment but an actual machine used to generate current for actual electro-plating.

If the line-cutting advocates had been called upon to predict the result of the disk experiment, previously unknown to them, there might have been some hesitation and clearing of throats while they tried to decide whether the part of the circuit formed by the disk was or was not cutting the magnetic field. At first sight it might seem not, since no change in the form of the circuit takes place, and the copper in any one part of the disk is as good as in any other. But if members of this group were electron-minded (as the participants in the I.E.E. discussion apparently were not, for the word "electron" was hardly mentioned) they would realize that turning the disk carried the free electrons in the copper around with it, and so causes them to move in a magnetic field, and by using Fleming's right-hand rule (thumb indicating direction of motion and forefinger direction of field, then second finger shows direction of e.m.f.) they would correctly predict an e.m.f. along the radius of the disk crossed by the field.

Having tactfully allowed the linkage people time to think up a way of talking themselves out of the contradiction between their theory and this experiment, we come back to them and invite their com-

ments on it. The I.E.E. discussion showed what at least one of them would say. He would describe the result as an anomaly, and shamelessly advocate keeping it as dark as possible, lest it confuse his students. I hope we all regard this reply as thoroughly unworthy and unsatisfactory and insist on something less ostrich-like. Pressed thus, some might allow it to be brought to the notice of their students, but only as a "special case" or "exception". But if nothing better can be said than this one would, I should think, be obliged to decide in favour of the line-cutting school, even though that meant accepting their curious pictures of lines cutting wires by springing out of them. Another group, represented in subsequent discussion by at least one very eminent authority†, refuses to be disconcerted by this attack on the linkage position, but shows that the disk experiment is, after all, not an exception to it. They ask one first of all to substitute for the disk a spoked wheel, and then show that the sector-shaped circuits formed by pairs of adjacent spokes and the segments of rim joining them obviously do link with a varying number of magnetic lines as the wheel is rotated, and that a difference of potential is thereby set up between the two brushes. They point out that this state of affairs does not depend on the number of spokes, and that more can be added until finally they are touching one another all the way, and the wheel has become the solid disk of Faraday.

Having re-established the prestige of the linkage school (and, we hope, expelled those members of it who disgraced it with their treacherous ostrich policy), they go on to conquer other supposedly fatal objections. One of the most interesting of these is Hering's experiment. It is performed with a circuit consisting of a spring clip, normally closed as in Fig. 3(a). The bar magnet M is then forced past the jaws (b) until finally it is inside (c). There is a complete circuit all the time, and clearly a large number of magnetic linkages are introduced into it, yet the most sensitive instrument fails to indicate any e.m.f. This, it is said by some, makes nonsense of the flux linkage idea. It certainly makes nonsense of something, and so it ought, for that something is a misconception of the linkage principle. The fallacy lies in looking at (a) and (c) only, which show an identical circuit with and without a linked field, and forgetting about (b), where the circuit is not identical. As Carrothers and Kapp put it, "the circuit in which one might expect a current to be induced is not there during the time that any inducing could occur."

† "Apparent Failures of the Flux-Threading Rule," by C. G. Carrothers and R. O. Kapp, *Bulletin of Electrical Engineering Education*, June, 1954, pp. 7-12.

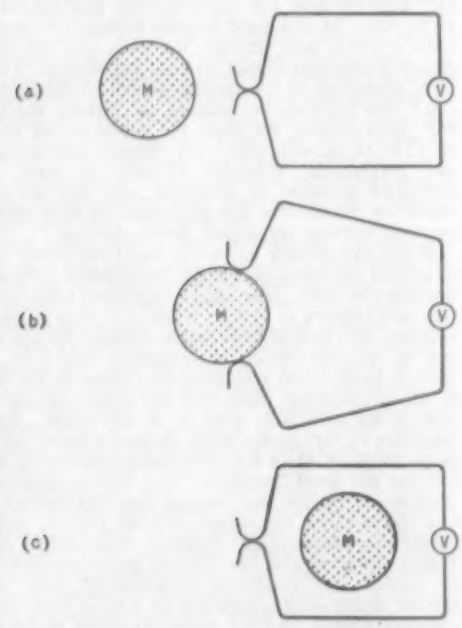


Fig. 3. M is a metal bar magnet which is pushed through the jaws of a spring clip forming a closed circuit. V is a sensitive voltmeter or galvanometer. Does it give any sign while the magnet is being inserted into the circuit? If not, why not? See Fig. 4.

When Is a Circuit . . . ?

This matter of change of circuit needs careful watching, for some changes of circuit during a linking or unlinking process do not necessarily affect the observed e.m.f., and the distinction is sometimes rather a subtle one—as it is in the Hering experiment. For example, altering the shape or extending the length of a flexible lead from a transformer coil to a voltmeter doesn't prevent the ordinary linkage rule from being used to predict the voltage correctly. But the change in circuit during the (b) period in Fig. 3 does upset what might seem to be a valid application of the rule. This can perhaps be more easily seen in Fig. 4. The right-hand part of the double wire square at (a) is not linked with the flux passing through the magnet M. If now the switch is opened (b) the magnet can be moved through into the right-hand square (c) but doing so does not alter the number of lines linked with the circuit that then exists. If now the switch is closed (d) there is a closed circuit the same as in (a), but linking with flux that was not there before. Yet there was no stage at which one would expect V to give a reading.

The fact that in the Hering experiment the switch-over is gradual makes no real difference. The process can be more exactly imitated by the arrangement in Fig. 5, in which the slider is moved from the position shown, where the magnet is not embraced by the circuit (the path through the resistance is dead-shorted by the direct path), to the other end, where it is. No one, surely, would expect moving the slider to set up a potential difference between *a* and *b*, such as certainly would be set up if a wire between *a* and *b* were moved across the pole face of the magnet.

Another demonstration in which the number of circuit linkages is increased by a sort of trick, without generating any e.m.f., is Blondel's experiment, shown in Fig. 6. Wire is wound from a metal cylinder, which acts as a short-circuit, to an insulating cylinder fitted with a metal slip-ring, with which contact is made by a brush B1. This cylinder is placed in an axial magnetic field. By rotating the cylinder, the number of turns linking with the field is made to increase gradually from none at all up to the maximum provided. Yet no e.m.f. is indicated. Nor should one be expected, for it is a sort of continuous Hering experiment.

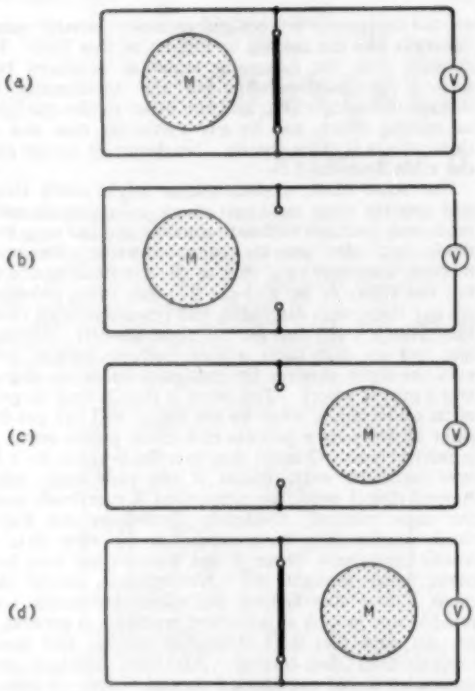


Fig. 4. This variation of the Fig. 3 experiment may make it easier to answer the questions about Fig. 3. If it doesn't, see Fig. 5.

What is the moral of all this? Of the people we questioned, who are right and who are wrong? And what about the people who don't seem to have been represented in our Gallup poll, who refuses to acknowledge the very existence of magnetic fields? Are they like those who hold on to the belief that the earth is flat, regardless of the clear evidence to the contrary? Or are they the only ones who are right?

Before we can answer we shall have to decide what, in this connection, "right" and "wrong" mean. If we think that any rule or theory or idea is—or could be—*the* right one, we had better think again. In such a question as deciding which of several men in an identification parade stole our wallet last night, it would be possible (whether by luck or good observation) to be right. But in such matters as stating precisely how electromagnetic induction works, nobody can be right, because there are no still more fundamental terms with which to describe the fundamental processes of nature. We can describe the construction and working of a machine, because it is made up of simpler parts that are familiar. But if we press the analysis back to such things as electrons we cannot say what they are made of. If we begin to describe an electron as "a very tiny particle . . ." we are not really describing it, because one should immediately ask "What is a particle?" and the enquiry would never end satisfactorily, because we would be committing the logical sin of defining the obscure in terms of the more obscure. A particle, as commonly understood, is a more complex structure than an electron. If we could start with a knowledge about electrons and such things, then perhaps we could go on to describe

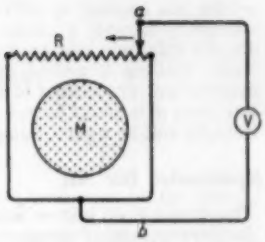


Fig. 5 (right). R is a resistor with a sliding contact which is moved from one end to the other. Do you still feel sure about Fig. 3?

a particle of matter accurately. But even if one day we find that an electron is made of still simpler units, that will only transfer our ignorance from the electron to them.

A Cloak for Ignorance

It is the same with induction. When we talk about lines of force, flux, and even fields, we are using these terms to hide our complete ignorance of what is really happening. All we know is that when certain conditions are provided certain results invariably follow. And what we do in the science of the subject is to state as precisely as possible the relationship between cause and effect. To assist in this it is necessary for most people to use mental pictures or concepts. The test of such a concept is not whether it corresponds accurately with ultimate reality—we wouldn't know—but whether it is (a) consistent with all observed behaviour, and (b) convenient for its purpose. Of these requirements, (a) might at first sight seem to be essential, but in practice, for the sake of (b), one often uses concepts that only approximately fit the facts, or fit only some of the facts; this apparently unscientific practice is allowable so long as the limitations are clearly understood by all concerned. The position is complicated, however, by (b) being so largely a matter of opinion.

Let's face it—we just don't know how or why it is that pushing a magnet into a coil of wire causes a voltmeter across its terminals to indicate. Probably no one will ever know. But all electrical engineers have to be able to make use of this fact to obtain desired results, such as providing light, heat, and television in our homes. Since it would be difficult to discuss such matters if blanks had to be inserted in place of words wherever our absolute knowledge was lacking, it is necessary to use concepts. To most

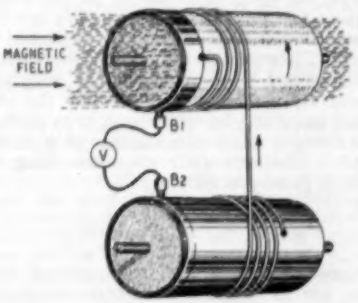


Fig. 6. This is a machine for causing an increasing number of turns to be linked with a magnetic field. Does this process cause V to read? If so, why?

people, the concept of a "field"—a sort of sphere of influence—around a magnet renders it easier to discuss induction and to make the necessary calculations. Calling it a field does not in the very least increase our knowledge of it, or prove that it exists. But even if it could be proved that it does not exist, it might still be a good thing to keep it as a concept.

Spectacles for All

The concept of just a field is still too vague and shadowy for most people. So lines of force were invented. Now in so far as anything about a magnetic field *can* be known, it is known that lines of force do *not* exist. They are simply a means of showing on diagrams—or visualizing in the mind—the directions in which fields act. They also help to suggest, by their closeness together, the relative strength of the field. As great a mind as Faraday's was not ashamed to use them as a mental aid. In just the same way contour lines on a map help one to visualize the direction and steepness of a slope, but supposing that a magnetic field actually consists of lines is as sensible as supposing that a hillside consists of lines. Yet so firmly does the line idea get one that it is quite difficult not to imagine that if a cylindrical bar magnet were rotated about its axis its lines of force would rotate with it and generate an e.m.f. in a stationary circuit through which they passed. But if we think of the field as we should, as having at any point only magnitude and direction, we realize that turning the magnet does not alter either of these properties anywhere, so is incapable of inducing an e.m.f. in an external circuit (though the stationary field does generate an e.m.f. in the rotating metal of the magnet itself).

Calling the unit of flux a "line," as some people still do, so that magnets are bought and sold on a specification of the number of lines they provide, makes the line idea even more difficult to keep in its proper place. Calling it a maxwell was better, but one couldn't help remembering that 1 maxwell is equal to 1 line. Now that the maxwell has been superseded by the weber, which is equal to 10^8 maxwells, there may be a better chance of thinking of flux as a continuous magnitude, like length or inductance.

To Clerk Maxwell, Faraday's lines seemed rather quaint; as a mathematician he found a mathematical symbol more appropriate and precise. Mathematical symbols themselves are only concepts, of course, but it must be admitted that they are the most precise and flexible way of stating generalized results of observations. For example, observations on electrons have shown them to have properties that defy any "mechanical model" to imitate, but can be expressed mathematically. Unfortunately only people with exceptionally mathematical minds can get any enlightenment from these expressions. To generalize the observed facts about induction by magnetism, even such a lucid writer as Faraday required a sentence of no fewer than 126 words. Mathematically the same thing can be stated much more precisely thus:

$$\oint \mathbf{e}.d\mathbf{l} = -\frac{d}{dt}\iint \mathbf{B}.d\mathbf{a}$$

But there are plenty even of qualified electrical engineers, not to mention elementary students, who fail to appreciate this way of putting it. However, according to the author of the paper discussed at the I.E.E., those who can should escape falling into the silly misunderstandings of those of us who through mental incapacity are obliged to make do with visual concepts like the cutting or linking of flux lines. He showed that the foregoing equation produces two terms, one corresponding to the transformer or linkage-changing effect, and the other to the motional or cutting effect, and in any particular case one of these effects is often absent. No doubt he always gets the right answers.

But some other mathematician might come along and express what we know about induction in some other way, perhaps without reference at all to magnetic fields, and also get the right answers. We poor morons who haven't a clue to these refined methods, but use either or both of the two flux rules, provided we use them with discretion and beware of trick cases like Hering's, can also get the right answers. Perhaps one day we may meet a Viet Namese refugee who gets the right answers by manipulation of an abacus and a prayer wheel. The point is that as long as each of us understands what we are doing, and can get the right answers by a process that to us makes sense, it is mistaken zeal to insist that everybody must do it in one particular way, which is the only right way. Agreed that it would be convenient if everybody used the same method. Evidently Carrothers and Kapp think so, for they have expressed the view that it would have been better if the flux-cutting rule had never been thought of! Nevertheless, while like them I find flux-linking the most convenient and reliable way to look at induction problems in general, I am not sure that it is invariably simpler and more natural than flux-cutting. All such concepts are spectacles to aid our limited mental vision. I would hesitate to insist that everyone must use a replica of mine.

ONE way of solving the battery problem—but perhaps more suitable for nomadic Arabs than for stay-at-home Britons—is exemplified by this new transistor transmitter, which is powered entirely by sunlight through the medium of selenium cells. Built by Edward Keonjian (General Electric Company of America), it has a range of about 100ft.

CONVECTION HEATING

FORCED OR NATURAL?

Broadly speaking, there are two types of convection heater: the *natural* convection heater, which depends for its operation solely on the physical difference in the density of warm and cold air, and the *forced* convection heater, in which a fan is used to force warmed air downwards and forwards, away from the heater.

Although natural convectors have their uses—for example in halls, landings or passages, which are not normally occupied for lengthy periods—forced convectors are much more efficient and economical in operation.

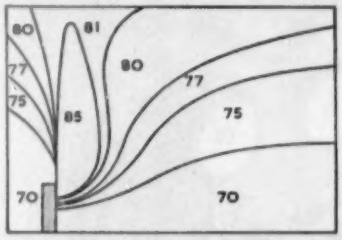


Fig. 1 *Diagram showing the heat zones produced by a typical 1 kW natural convection heater. The upwards and outwards path of the warm air is quite clearly indicated. If the power of the heater were increased to 2 kW, temperatures in the particular zones would increase, but the general disposition of the zones would remain the same. The air at floor level would therefore be noticeably colder.* (*Temperatures in both illustrations are in degrees Fahrenheit.*)

A natural convector warms only the air passing through it and in its immediate vicinity, and this warmed air, being much lighter than the main body of air in the room, rises rapidly towards the ceiling, where most of the heat is dissipated. Although there will be at times a certain amount of mixing of small portions of rising warmed air with the general body of colder air, due to movement of persons in the room, the fact remains that in general the warmest air will be at ceiling level, and the colder air at floor level.

Thus, before the occupants of a room heated by natural convection feel very much benefit, the temperature of the air at ceiling level has to be increased considerably. Obviously, overall room temperature increases very slowly, and power consumption, and therefore costs, are increased.

The steep temperature gradient created by this method of heating often gives the occupants of a room the impression of draughts around the feet and a feeling of "headiness." This arises because, while the human body can withstand a higher temperature around the feet and legs, it cannot, with comfort, tolerate an atmosphere in which there is an upper zone of much warmer air. This warm upper zone, being semi-static in nature, also tends to act as a barrier to rising tobacco smoke and other fumes, thereby worsening the general atmospheric condition. A further disadvantage of natural convection heating is the soiling of the walls and ceiling immediately above the heater caused by the uprising air current becoming dust laden.

Much time and effort have been expended on natural convectors in attempts to overcome these disadvantages, all of which arise from the very low velocity of the warmed air emerging from the heater outlet. In spite of these efforts, experiments show that the maximum distance the warmed air can be projected from the outlet of this type of heater is about 6 inches.

With the *forced* air convection heater the effects are the opposite of those occurring with the natural convector. By using a suitable blower system the warmed air is forced, against its natural tendency, downwards and outwards into the room. This stream of warmed air is given sufficient velocity to project it some ten to fourteen feet from the heater.

Unlike the natural convection heater, the forced air convection heater produces the warmer air zone at floor level. The temperature gradient throughout the room is very much less than with a natural convector: the difference in temperature being as little as 5°F between floor level and ceiling.

Thus, with forced convection heating, the warmed air is circulated throughout the entire room and rapidly increases the overall temperature; there is no draughtiness around the occupants' feet, and since the upper air is at a slightly lower temperature than the air at floor level, there is no feeling of "headiness." Other advantages of the forced convector lie in better physical design. In order to get maximum air velocity natural convection heaters are usually tall in relation to their width and depth: not always an ideal shape from the points of view of stability and convenience in placing in a room. Forced convectors can be designed to much more stable dimensions, and can be made compact enough to fit unobtrusively into any convenient position. Furthermore, forced convectors will

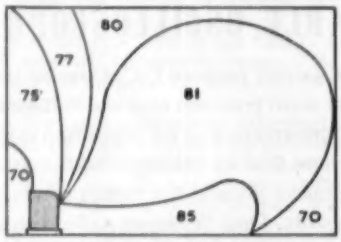


Fig. 2 *Heat zones produced by a forced convection heater, the "H.M.V." 2 kW Cavendish Heater. Note the even temperature gradient throughout the entire room, with the warmer air zone at floor level. These figures were plotted from actual tests taken in a room measuring* 14′ × 11′ 3″ × 8′ *high* (1,265 *cu. ft.*), *with a semi-circular bay containing* 5 *windows.*

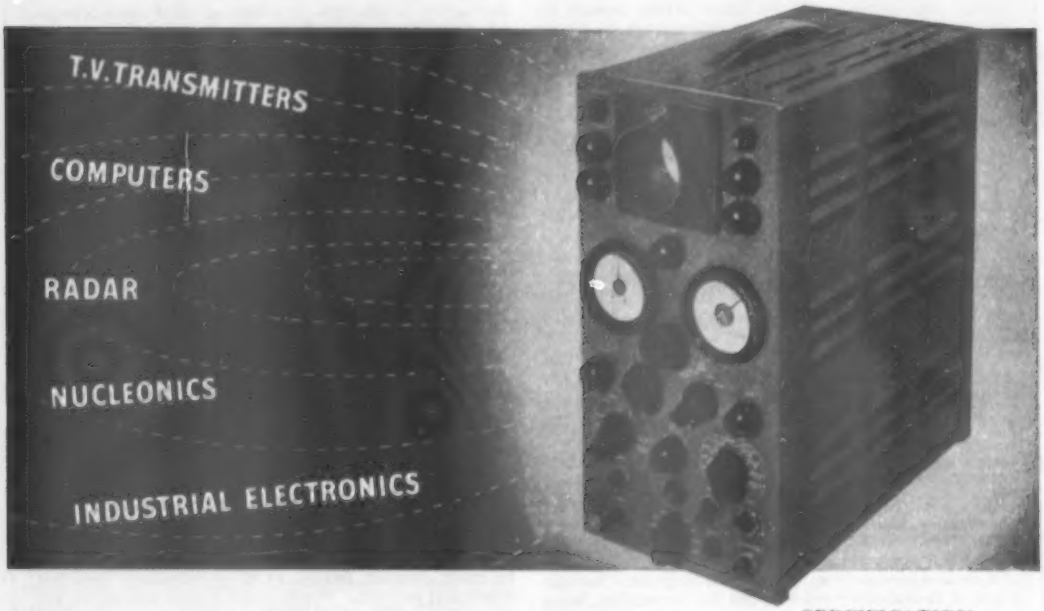
operate with unimpaired efficiency even when sited below a window. Cold air currents in the vicinity of the window gravitate towards the floor, where instead of creating a draught as they would normally do, they are warmed by the heater and circulated into the room. Similarly, cool fresh air entering the room through the window will be warmed by the heater and will help to keep the air within the room fresh and clean.

HMV HOUSEHOLD APPLIANCES

H.M.V. HOUSEHOLD APPLIANCES DIVISION · THE GRAMOPHONE CO. LTD. · HAYES · MIDDLESEX

E·M·I ELECTRONIC EQUIPMENT

FOR RESEARCH, DEVELOPMENT and TESTING



PORTABLE OSCILLOSCOPE TYPE WM.3.B.

A compact general purpose D.C. Coupled portable Oscilloscope with facilities for rapid precision time and voltage measurements. Volts and time meter presentation — no calibration markers required. Displayed waveform measured by voltmeter bridge system (visual null balance). 9 range voltmeter gives high accuracy readings unaffected by amplifier gain or linearity. Dual 'Y' input paths with attenuators afford signal comparison and mixing facilities. Floating circuit enables AC/DC signals to be measured with respect to D.C. potentials within ±500V.

SPECIFICATION

C.R.T. E.H.T. 0.8 & 1.2 kV.

'Y' Amplifier D.C. - 6 Mc/s.

MAX. SENSITIVITY
350 mm/V (at reduced bandwidth)

VOLTAGE MEASUREMENT
±10 mV to ±500 V AC/DC
± 2½% F.S.D.

TIME MEASUREMENT
0.25 microseconds - 40 milliseconds

SWEEP DRIVE
Triggered or recurrent, phase and frequency selected

WRITING SPEED
6 milli-seconds/cm - 0.5 microsecond/cm

DISTRIBUTED AMPLIFIER TYPE 2B 50 c/s — 100 Mc/s

A unit designed for use with high speed Oscilloscopes to provide amplification over a very wide frequency spectrum at high output voltage levels.
The amplifier is extensively used in the study of high speed waveforms having rise times in the milli-microsecond range. It is being widely used with scintillation and coincidence counters, high speed scalers, and signal generators.

SPECIFICATION

Input Impedance, 75 ohms. Output Impedance, 200 ohms nominal. Max. Output, 150 Vpp. Bandwidth, 50 c/s–100 Mc/s. Phase Response, Substantially linear over pass band. Gain, x 12.

For further details write to:

E.M.I. FACTORIES LTD. HAYES, MIDDLESEX. Phone: Southall 2468 Ext: 857 & 655

EF.88

Measurement of Rise-Time

Simple Circuits for Displaying Pulse Characteristics

By E. G. DANN

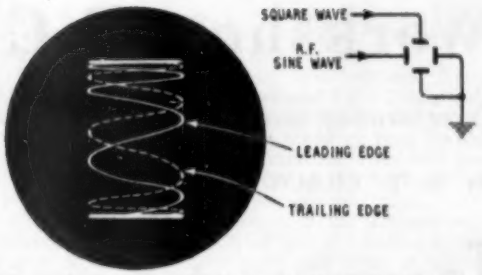


Fig. 2. (Above) Display obtained when a sinusoidal r.f. voltage is applied to the horizontal deflecting plates.

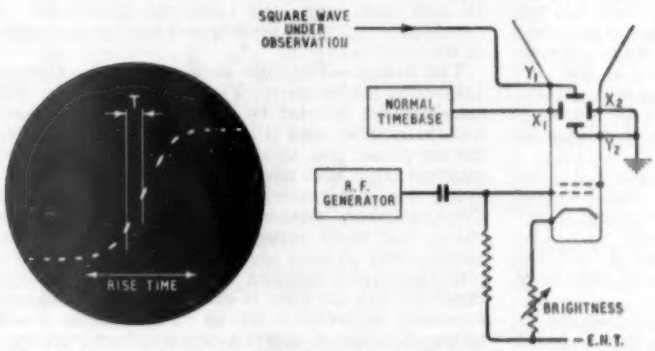


Fig. 1. Time markers derived from the positive half-cycles of a radio-frequency input to the c.r.t. grid.

THE experimenter may on occasions wish to make some observation which is beyond the normal capabilities of his test gear, either as regards the range of measurement or the degree of accuracy available. In these circumstances it is necessary to find some method by which existing equipment may be used to obtain the desired result.

The writer recently needed to make a measurement of the rise-time of the output of a multivibrator, and, while the repetition frequency could be ascertained with a reasonable degree of accuracy, the time-base of the oscilloscope used was insufficiently well calibrated to measure the time of rise of the positive excursion of the square wave.

One well-known method of providing an accurate time scale is to feed a radio frequency to the grid of the cathode-ray tube on which the waveform is displayed. This results in a brightening of the trace over the positive half-cycles of the r.f. wave as shown in Fig. 1. Since the distance between dots corresponds to the periodic time T of the r.f. wave, a fairly good assessment of the rise-time can be made.

Sinusoidal R.F. Time-base

A more accurate method of measuring rise-time devised by the writer is one in which the normal time-base of the oscilloscope is replaced by the output of an r.f. generator. Since the leading edge of the waveform under investigation has some pretensions to linearity the resulting pattern is a series of waves with a vertical time axis. Thus, by observation of the number of cycles displayed and from knowledge of the applied radio frequency, the rise-time may be accurately determined. (See Fig. 2.) For example, if a stationary trace with a convenient number of vertical waves results when the applied frequency is 1.8 Mc/s, the rise time is 1/1.8N microseconds, where N is the number of whole waves displayed.

Bunching of the cycles at the top of the pattern is an indication of slower rate of rise of the upper portion of the leading edge of the square wave.

A simple pattern of the kind shown in Fig. 2 will result only when there is an integral ratio between the square-wave frequency and the applied radio frequency, as follows from the normal behaviour of Lissajous figures.

The insertion of a filter in the lead to the oscilloscope X plates will improve the purity of the r.f. cycles displayed by elimination of harmonics in the output of the r f. generator.

Due to the fact that the square wave must necessarily have a negative-going excursion the pattern will ordinarily show a return trace and this will afford observation of the fall-time. If, however, the oscilloscope has provision for blackout of its normal fly-back and remains synchronized with the square wave, the return trace will not normally be displayed.

A PARABOLOID four feet in diameter is mounted on top of this 60-ft mobile extensible mast which the B.B.C. has recently introduced for television outside broadcasts. The aerial, which can be remotely rotated through 360°, can be adjusted to within ±1°. When extended the mast is self supporting but provision is made for stay wires if needed.

Workshop R-C Bridge

Incorporating a 1,000-c/s Source and a Protected Sensitive Indicator

By B. T. GILLING

THE instrument to be described was designed by the writer for quick but searching tests of capacitors and resistors in the workshop. It is actually two test instruments in one, namely a resistance-capacitance bridge and a direct-reading leakage indicator for testing electrolytic capacitors at voltages up to 500. As will become apparent, one of its features is its robustness. Although extremely sensitive the instrument is so designed that there is no possibility of damage by overload, even if it is carelessly used.

The full circuit diagram is shown in Fig. 1 and can be divided into five parts as follows: signal source, bridge, bridge indicator, leakage indicator and power supply. These will be dealt with in turn. It will be seen that only one pair of test terminals is used, the required facility being selected by the three-pole switch, S4.

Signal Source.—An alternating-current source is needed, and it is possible to obtain this from a special winding on the mains transformer, but the reactance of capacitors in the picofarad range to 50 c/s is inconveniently large. An R-C oscillator of a very simple design is used in the instrument and the circuit values shown give a frequency of about 1,000 c/s when the voltage at the h.t. decoupling point is 150. The value of the 68-kΩ decoupling resistor may need modification to obtain this voltage.

The output waveform and amplitude are controlled by the cathode resistor, and some slight adjustment of this may be needed. The output transformer T1 is a small 6:1 intervalve type using the high-inductance winding as primary. Any small transformer of about this ratio is suitable provided that the high-resistance winding will carry 5 mA. A Wearite transformer Type 262 is actually used and gives an output of 18 volts peak across the 1,000-ohm ratio arms. A transformer T2 of the same type is used at the output of the indicator.

The Bridge.—The ratio arms consist of a Colvern 1,000-ohm potentiometer Type CLR 7001/15. The standards are selected by switch S3, their tolerance and the number used is limited only by expense, but the six shown give an adequate coverage. Should a standard other than one of those included be needed at any time it is connected to the "Match" terminals. Cracked-carbon close-tolerance resistors are quite cheap, but really accurate capacitors are, unfortunately, costly. A point to remember when buying them is that a capacitor supplied to a definite value is always expensive, but one close to the desired value and very accurately calibrated is less so. For example, it will be less expensive to accept a capacitor from stock calibrated at, say, 0.0988 μF than to insist on one of 0.1 μF ±½ per cent. Provided the value is low it can always be made up to the desired value with added capacitance.

The 100-ohm variable resistor in series with the 1-μF standard is to enable a sharp balance to be obtained with capacitors having appreciable losses. If desired this control can be calibrated by the experimenter to give an indication of the relative magnitude of the losses.

A decade resistance box must be considered essential for calibrating the ratio arms and the use of one can usually be obtained at a local technical school, or a suitable approach will often get the co-operation of

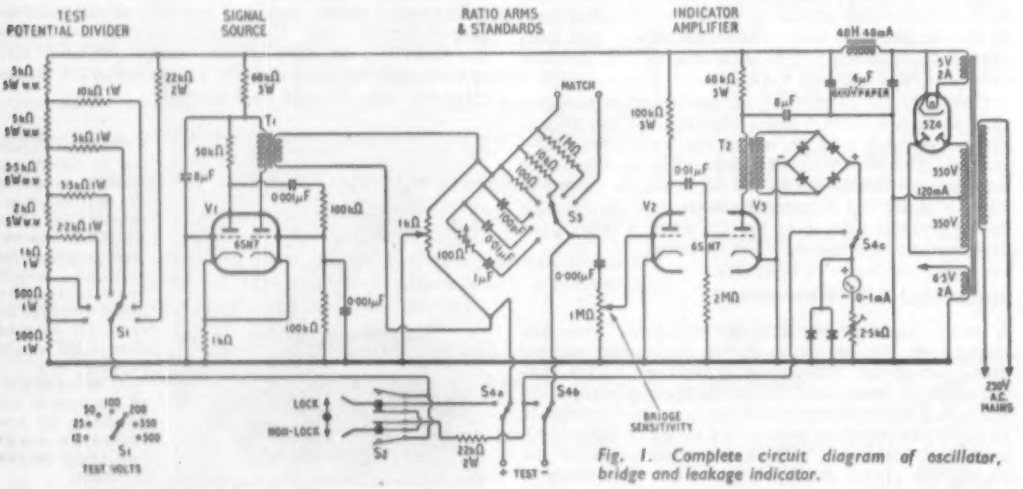


Fig. 1. Complete circuit diagram of oscillator, bridge and leakage indicator.

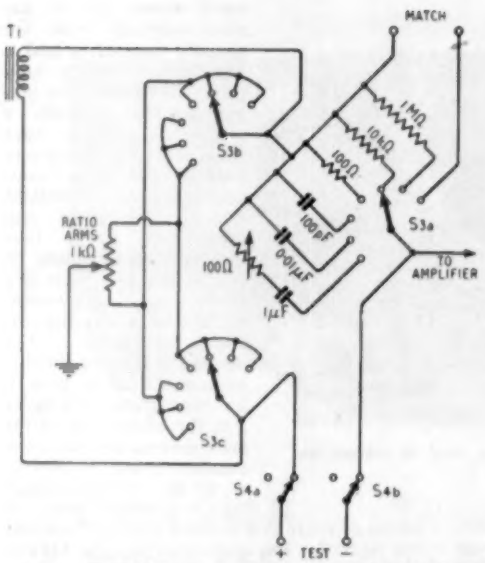


Fig. 2. The addition of two wafers to switch S3 in Fig. 1 permits the use of a single calibration for the ratio-arm scale.

R.E.M.E. or even of a Post Office engineer. At any rate, it is not the insuperable difficulty that it is often made out to be.

The circuit, as set out in Fig. 1, will need two scales on the ratio arms, one the reciprocal of the other, since low resistance and high capacity will be at the same end. Since the resistance element is linear and very evenly wound, the ratio arms can be reversed for capacity measurement and only a single scale will be needed. This is carried into effect as shown in Fig. 2 by using two additional wafers on the standards switch. It is an embellishment well worth incorporating as it simplifies the use of the instrument considerably.

Indicator.—The indicator consists of two parts, the amplifier and the meter. The first comprises two valves operated at zero bias. As the ratio arms move away from the null point the signal to V2 increases and when it exceeds a certain amplitude V2 and V3 act as limiters. The output waveform from the limiters is very distorted but this is of no consequence since the important part of the signal is around the point of balance and then its amplitude is too small to overload the valves.

The output from the amplifier is passed through a step-down transformer, of the same type as that used in the oscillator, to a bridge rectifier and thence by switch S4c. to the meter. This meter movement has a full-scale deflection of 1 mA and has two half-wave metal rectifiers connected back-to-back across it. These act as a variable shunt. When a low voltage is applied to it a metal rectifier has a fairly high resistance, but as the voltage is increased so the resistance decreases shunting a greater proportion of the current away from the meter. The second rectifier section is to protect the meter from any reverse current which may appear in certain conditions when it is being used as a leakage indicator. The 2,500-ohm variable resistor in series with the meter is to enable its maximum deflection to be adjusted to full scale when setting up the leakage indicator with 25 mA in the shunted circuit.

The rectifiers are both by Westinghouse, Type 4/1A is used as meter rectifier and Type 2/6A, with its outside ends connected together, as the shunt. Alternatively, rectifiers can be made up from an old copper-oxide unit; the bridge consists of one disc per section and the shunt of six per section with one set reversed. No cooling fins are needed.

Fig. 3 illustrates the action of the limiters and rectifier shunt combined. Balance is assumed at the centre of the ratio arms scale and curve A shows the output with no limiting action when care is taken not to overload the meter. The curve is very open and the null point not at all clearly defined. If the balance is to be made sharper a curve such as B is needed which assumes amplification but no limiting. This gives an excellent indication of balance; but when the arms are away from the null point the meter will be hopelessly overloaded and damage will inevitably result. With the limiters in use curve C is obtained, which has the sharpness of B, but which at no time exceeds the full scale deflection of the meter.

In practice the instrument gives a very sharp balance indeed. With the sensitivity control at maximum, as the ratio arm pointer is swung round the dial the meter remains at nearly its full scale deflection until the point of balance is reached. Then the meter moves from full scale to zero and back to full scale again in a matter of five to ten degrees. The sharpness of balance is maintained on all scales, and at the lower end of the 100-pF one it is easily possible to measure to within 0.5 pF. A point to remember when measuring these low capacities is that the residual capacity of the test leads must first be measured and this figure subtracted from the measured value of the component. On all the scales for ease of searching the sensitivity control needs to be set well back and only increased when a really close balance is required.

The total deflection of the meter in out-of-balance conditions is controlled by the anode voltage of V3,

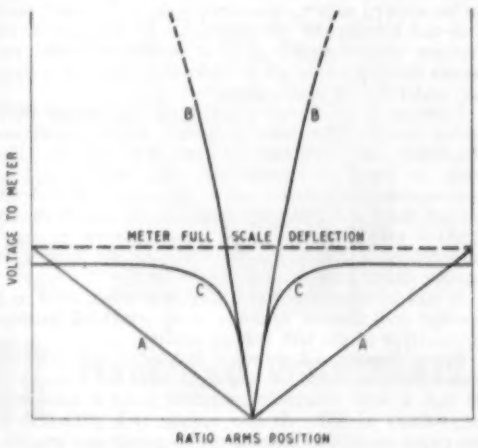
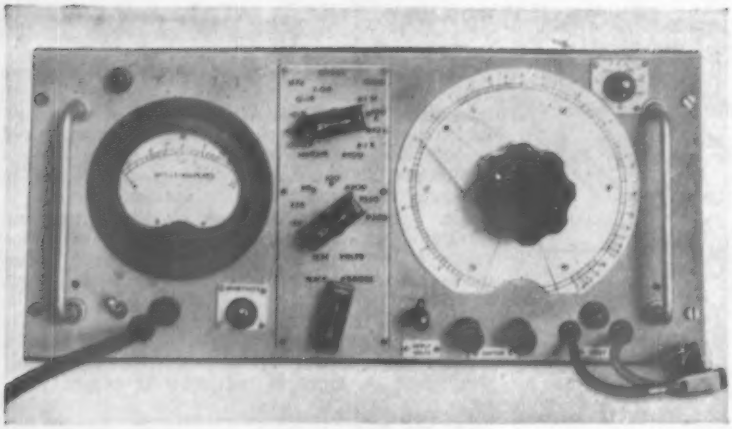


Fig. 3. Indicator response, with meter only (A), with amplification (B), and with amplification and limiting (C).



Layout of controls on the front panel. Black and red leads are used to indicate the polarity of the test clips.

and some slight adjustment of the value of the decoupling resistor to this valve may be needed. This should be done after the leakage indicator has been set up.

Leakage Indicator.—Provision is made to test the leakage of capacitors, especially electrolytics at voltages from 12 to 500 and these are selected by switch S1. Potential points are taken from the voltage divider chain across the h.t. supply and series resistors are introduced between these points and the selector switch contacts to limit the current flowing to 25 mA in each range when the test terminals are short circuited. This makes a limiting safeguard without impairing the value of the test, since, although at high current leakages the voltage at the test terminals is reduced greatly, as the leakage current decreases the voltage will rise until at 1 mA and under it reaches the full indicated potential.

The selected test voltage is applied to the capacitor by switch S2. This is a three-position key switch with one non-locking position, allowing the voltage to be applied either momentarily or for "soak" tests and the forming of electrolytics. In the central off position of the switch a 22-Ω resistor is connected across the test terminals to make sure that the capacitor under test is discharged.

Leakage is measured directly on the bridge indicating meter. The shunt rectifier is left in circuit and the meter scale calibrated by hand in milliamps. The scale is roughly logarithmic, 0-1 mA occupying approximately the first third of the scale, 1-10 mA the second third and full scale being set at 25 mA by the 2,500-Ω series resistor. As an alternative to hand calibration, a graph can be made of the new scale against the original linear one.

It will be seen that the instrument when used as a leakage indicator is immune from overload damage irrespective of the test voltage applied.

Power Supply.—A standard 350-0-350 volt, 120 mA transformer is used. At the light total h.t. current of 40 mA a 4-μF reservoir capacitor gives a smoothed h.t. voltage of 500. At this voltage it is advisable to use paper capacitors in both the reservoir and smoothing positions.

General.—The photograph of the author's instrument shows that it has more standards than are actually necessary, and a 3½in meter which happened to be available was incorporated although a smaller one would have given perfectly satisfactory results. The "Test" connections are brought through the panel and consist of about four inches of flex ending in crocodile clips. This is a much more convenient method than the conventional terminals. The method of figuring the dial calibrations can be seen in the photograph. The figure 1 at the middle top of the scale corresponds with the standard in use. No powers of 10 are indicated, each decade starting with 1. Over a period of years this method of calibration has been found to be far less confusing than the normal method in which a dial of this type would be calibrated 0.01-100. The added ciphers only lead to difficulties of interpretation.

BOOKS RECEIVED

Mathematics of Engineering Systems (Linear and Non-linear) by Derek F. Lawden, M.A. Treatise on differential equations and their solution by classical and modern methods, with examples of their application to problems arising in the design of electrical networks, amplifiers, oscillators and servomechanisms. Pp. 380+viii, Figs. 97, price 30s. Methuen and Company, Ltd., 36, Essex Street, London, W.C.1.

Active Networks by Vincent C. Rideout. Textbook of basic principles and formulae for students of communication engineering, including chapters on negative feedback, transient response of amplifiers, demodulation wave-shaping circuits, noise and information theory. Pp. 485+xvi; Figs. 364, price 42s. Constable and Company, Ltd., 10-12, Orange Street, London, W.C.2.

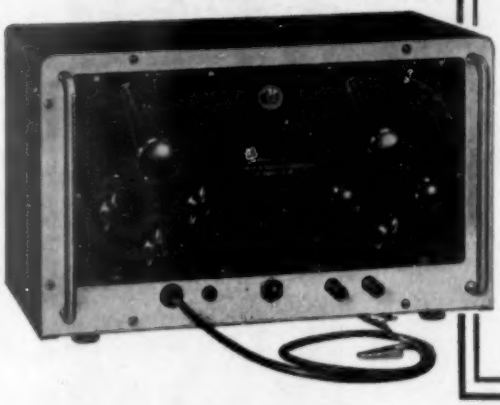
Valves for A.F. Amplifiers by E. Rodenhuis. Description of relevant Philips valve types, general hints on amplifier construction and eight complete circuits for amplifiers with outputs from 3 to 100 watts. Pp. 144+viii; Figs. 97. Price 10s 6d. Cleaver Hume Press, Ltd., 31, Wrights Lane, London, W.8.

The Inventor of the Valve, by J. T. MacGregor-Morris, D.Sc. (Eng.), M.I.E.E. A biography of Sir Ambrose Fleming, published to celebrate the 50th anniversary of his first valve patent. Pp. 124+xviii; Figs. 22. Price 10s. The Television Society, 164, Shaftesbury Avenue, London, W.C.2.

Audio Frequency Power Measurements, No. 8 in the series "Notes on Applied Science" published by the National Physical Laboratory. Discusses the basic principles and describes wattmeters of the electrostatic, thermal and electrodynamic type, their advantages and disadvantages. Pp. 16+iv; Figs. 8. Price 1s. Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2.

Transistors and Crystal Diodes, by B. R. Bettridge. Simple explanation of how they work, and how they can be applied by the experimenter in sound receivers, television sets and amplifiers. Pp. 72; Figs. 47. Price 5s. Norman Price (Publishers), Ltd., 283, City Road, London, E.C.1.

Wireless, by Frederick Roberts. History of the development of communication without wires, written for use in schools. Pp. 98; over 60 illustrations. Price 5s. The Educational Supply Association. Ltd., 181, High Holborn, London, W.C.1.



BE READY
FOR TOMORROW
— TODAY!

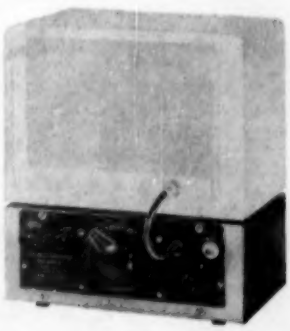
WITH THESE TWO *NEW*
COSSOR INSTRUMENTS

COSSOR Model 1322 | Telecheck and Marker Generator for Bands I and III

Model 1322 — used in conjunction with a cathode ray oscillograph — provides equipment for the display, measurement and correct adjustment of RF and IF response curves of television receivers. This entirely new instrument comprises a swept oscillator covering the Television BANDS I and III (5-75 Mc/s. and 155-255 Mc/s.) and a frequency marker oscillator so that precise calibration of the oscillograph display may be made; accuracy of the frequency of the marker pips being verified by reference to an internal crystal. The alignment oscillator is set to the video carrier to which the receiver is tuned and the sweep (either 1 Mc/s. or 10 Mc/s.) is automatically derived from the time base voltage of the display oscillograph. The response of the "strip" under test to the frequency band applied is then presented on the screen of the cathode ray tube. The RF output of Model 1322 is available at 75 ohms and is adjustable from a maximum of 40 millivolts to a minimum of 10 microvolts through a coarse and fine attenuator.

TELECHECK CONVERTER FOR BAND III Model 1321

This adaptor provides owners of Model 1320 "Telecheck" with an extension of the frequency range of the original instrument into the BAND III television channel. Thus, alignment procedures adopted for BAND I RF/IF "strips" are available also for BAND III receivers. A selection of the desired BAND is made by means of a switch. Pattern generator facilities for picture time base linearity checks have been retained. Model 1321 Adaptor is designed for permanent attachment to the standard "Telecheck" providing a neat, light and compact unit. Mounting is effected by four screws and the inter-connecting wiring is carried in a single insulating sleeve.



COSSOR ELECTRONIC INSTRUMENTS

Write for illustrated leaflets about both these instruments:

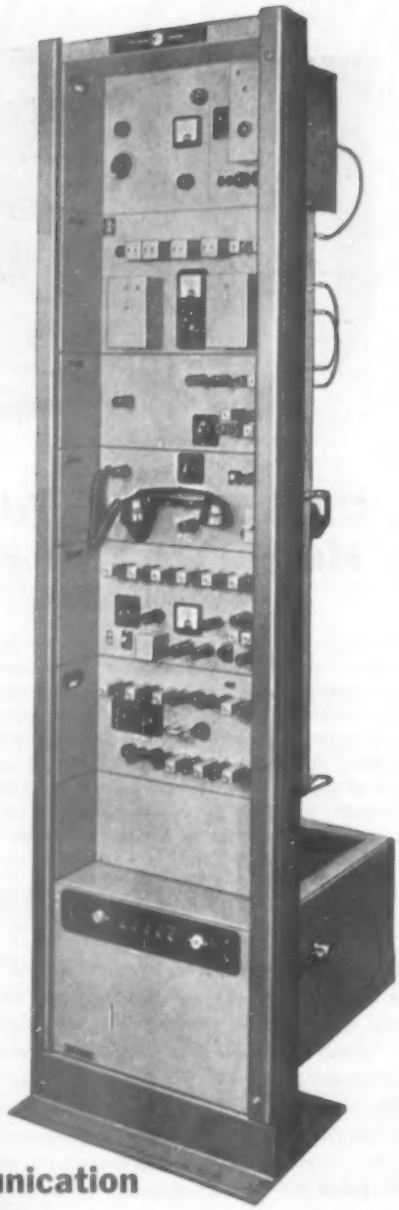
A. C. COSSOR LTD · INSTRUMENT DIVISION (Dept. 1) HIGHBURY GROVE · LONDON · N.5

Telephone: CANonbury 1234 (33 lines) *Telegrams: Cossor, Norphone, London* *Cables: Cossor, London*

F

Marconi VHF Multi-Channel Equipment

TYPE HM 181



Multi-channel radio links are not only recognised economic alternatives to line and cable routes wherever the latter are costly because of intensive urban development or the wild nature of the terrain; they are frequently preferable in their own right. The type HM 181 equipment has been designed for comparatively simple schemes using two terminals working point-to-point or with a limited number of repeaters. It operates in the frequency range 150-200 M/cs, employs frequency modulation and gives high performance with low distortion.

It provides the following facilities:—

- 8, 16 or 24 channels
- Repeaters with easy channel dropping facilities
- Unattended operation
- Engineers' order wire
- Ease of access for maintenance

Over 80 countries now have Marconi equipped telegraph and communication systems. Many of these are still giving trouble free service after more than twenty years in operation

Lifeline of communication

MARCONI

COMPLETE COMMUNICATION SYSTEMS

Surveyed, planned, installed, maintained

MARCONI'S WIRELESS TELEGRAPH CO., LTD., CHELMSFORD, ESSEX

Partners in progress with The **'ENGLISH ELECTRIC'** *Company Ltd.*

LC 7

"Piped" Scanning Waveforms

Unusual Wired Television System Giving Simpler Receivers

By E. J. GARGINI*

THE commercial success of sound broadcast relay companies can be attributed to the simplicity, and hence low initial and maintenance costs, of the terminal equipment. The design of television distribution equipment to the same order of simplicity is clearly desirable so long as the sending equipment and network costs do not become limiting factors. The system described here is based on the principle that terminal equipment should not include circuitry which may be transferred to the sending end, although at the same time this transference should be halted when it comes to power distribution.

Fig. 1 is a circuit of a vision terminal unit which embodies this principle. Two r.f. signals are transmitted over the input cable together with sound signals at service level. A choke assembly separates the sound signals (in a separate control unit) which are then applied to the loudspeakers. The higher frequency r.f. signal is a 5.42-Mc/s carrier wave modulated with picture information only. A vestigial sideband transmission is used, the upper sidebands being suppressed at the sending end. The lower frequency signal is a 1-Mc/s modulated carrier wave, and this effects the double-sideband transmission of a modulated waveform which includes line and frame scanning signals.[1,2]

By passing the demodulated scanning waveform through a low-pass filter a frame scanning waveform is developed, and by passing the demodulated waveform through a high-pass filter a line scanning waveform is obtained. Input filters at the terminal unit separate the two vision signals. The video carrier modulated signal is amplified in the N309 and then applied via a low-impedance coupling circuit (L_1 and L_2) to the grid of the c.r. tube. Adjustment of the tube bias to the condition that anode current only flows during positive-going carrier pulses results in the display of monochrome pictures at a dot spacing,

* Electric and Musical Industries. This article is based on a lecture which the author gave recently to the Tevision Society.

[1] British Patent 704141.

[2] British Patent Application No. 1668/53.

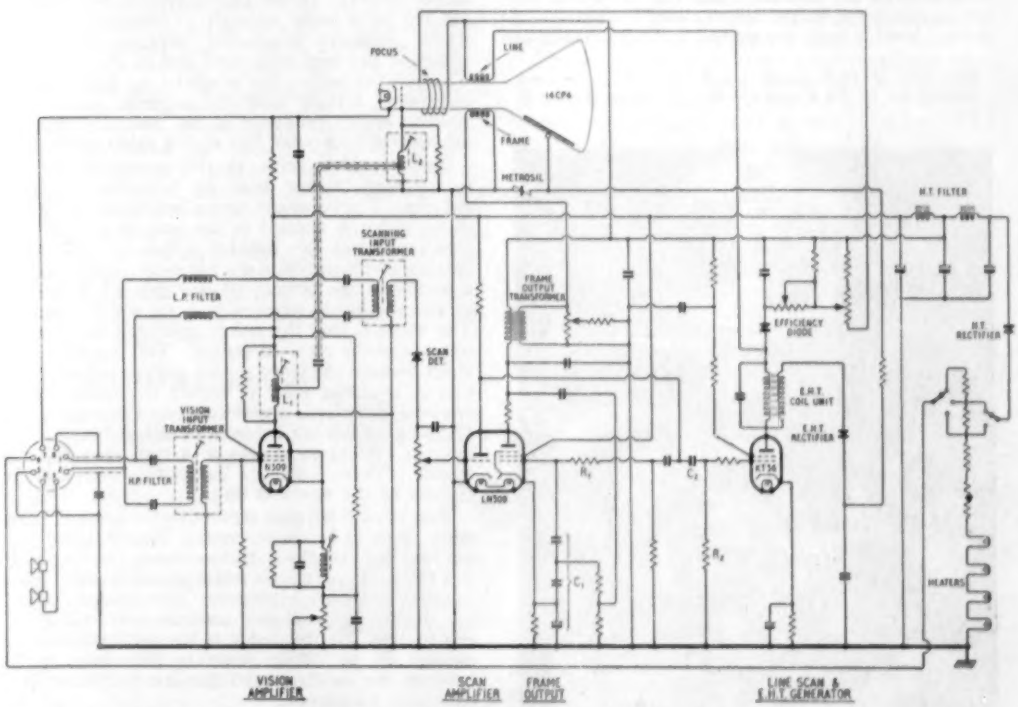


Fig. 1. Circuit of 3-valve subscriber's receiver. The eight contacts of the input plug on the left carry the following: 1 and 2, vision and scanning signals on carriers; 3 and 4, sound at speech-coil level; 5 and 6, mains supply; 7, brightness control voltage; 8, earth connection.

that is, the line is broken up into dots which correspond to the 5.42-Mc/s carrier waves. This tends to render the line structure less prominent.

The scanning signals, after rectification at a XT1 crystal diode and amplification by the triode section of the LN309, are applied to the network R_1 and C_1. The composite signal is integrated by this RC filter and the resulting frame sawtooth is applied to the pentode frame output stage. The composite scanning signal is differentiated by the high-pass filter C_2 R_7 which results in the production of a line-scanning sawtooth waveform. This is applied to the KT36 line output valve.

This output valve has in its anode circuit directly coupled scanning coils which are shunted by an efficiency diode circuit comprising a diode in series with a resistor shunted by a capacitor. The operation of this circuit is conventional. The diode circuit rectifies the negative overshoot which appears at the valve anode at the termination of the long flank of the sawtooth grid potential. The resulting current produces the first part of the line scanning signal through the coils. The initial positive rise of potential is applied to a section of a low-pass filter which, after rectification, provides e.h.t. for the c.r. tube.

Simple Adjustment

It will be noted that if the unit is constructed for a.c./d.c. mains operation and capacitance-coupled high-impedance frame coils are used, no iron-cored transformers are necessary. Moreover, no synchronizing controls are necessary and the subscriber only has to adjust the focus, contrast and brightness. As the d.c. level is fully maintained and zero carrier can represent black level, the separate brightness control may in certain circumstances be dispensed with.

Rear view of 14-in cabinet-model subscriber's receiver, showing the 3-valve chassis of which the circuit is given in Fig. 1.

This simplification has not been obtained without some complication of the sending and network equipment. Fig. 3 is a block diagram of the main waveform generator at the sending end. Fig. 2 (a) illustrates the envelope shape of the carrier wave when the carrier has been modulated by the frame scanning signals of the composite waveform. They are generally of a pulse-like character with interruptions between the pulses, which reduces the envelope amplitude to about 15% of the peak amplitude of the frame scanning signal. These interruptions correspond to the frame return intervals.

The line scanning signals are shown in Fig. 2 (b). These are of constant amplitude and of a sawtooth character. They comprise a linearly rising portion giving way to a ripple of between 50 and 60 kc/s. Interruptions in the waveform correspond to the line return intervals. When the line and frame signals are combined the line frequency components occurring during the frame flyback period are considerably reduced in amplitude. During the curved portion of the frame waveform the line scanning signals modulate the carrier wave to 90% at the beginning of the portion and to 60% at the end.

In Fig. 3 the input signal is the complete video signal obtained from a receiver at the sending installation. A circuit suppresses the video signals, leaving the sync pulses, which are fed in parallel and with negative polarity to two groups of circuits, one for line waveforms (above) and the other for frame waveforms (below). In the line waveform channel pulses are fed to a valve through a differentiating circuit which produces alternative negative and positive spikes at the beginning and end of the sync pulses. The positive spikes are removed by grid current in the valve, leaving only the negative spikes. The positive spikes produced at the anode of this valve are applied to a delay line with a delay of 90 μsec.

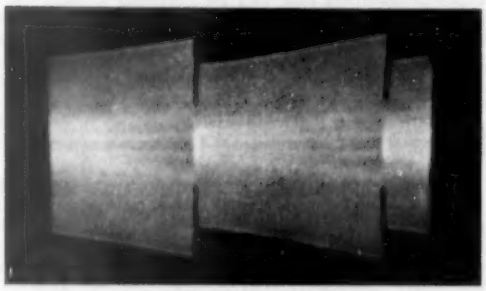
Each positive spike at the anode of the valve is followed 90 μsec later by a spike of negative polarity. The resultant output waveform at the anode of the valve is applied to the grid of another valve, which removes the positive spikes by grid current limitation and amplifies the negative spikes to produce a positive spike output, 90 μsec delayed with respect to the sync pulses received from the vision suppressor. The effect is that the spikes produced are 10 μsec in advance of the received pulses. This advance is provided because the video signals are relayed as modulation of a carrier wave of higher frequency than the scanning waveform signal carrier. Consequently the scanning signals are liable to be delayed in the transmission system to a greater extent than the video signals. There may also be relative delays in filter circuits at the terminal unit.

The 10-μsec advance represents the greatest relative delay likely to be encountered. The advanced pulses are next fed to a phase discriminating circuit included in a flywheel sync circuit which also includes a cathode-coupled sine-wave oscillator. The voltage output of the discriminator circuit controls a reactance valve and thereby the frequency of the oscillator in such a manner as to obtain accurate frequency tracking between the oscillator and the line frequency of the television programme.

Negative pulses set up at the anode of the oscillator valve are applied to a differentiating circuit. The differentiated output of negative and positive spikes

(a) (b)

Fig. 2. (a) Envelope shape of the frame scanning signal modulated on its carrier wave, (b) envelope of the line scanning signal on its carrier.



Composite scanning waveform from the sending generator, produced by combining the line and frame waveforms in Fig. 2.

are applied to the grid of a valve forming part of a sawtooth waveform generator. This valve is normally biased off except on the occurrence of positive spikes at its grid. These positive spikes discharge a capacitor in the circuit and generate the short flank of a sawtooth waveform. During conduction of the valve an anode-cathode potential drop produces one of the interruptions in the line scanning signals (Fig. 2 (b)).

The waveform at the anode of the sawtooth oscillator is applied to a shaping circuit which has the effect of providing a relatively sharp transition from the interruption to the linear part. The waveform is then fed through two cathode follower amplifier stages. The output from the first of these is adjustable so that the amplitude of the line scanning signal may be adjusted without introducing waveform distortion. The second cathode follower stage acts as a line and frame combining stage.

Frame Waveform Generator

Returning now to the vision suppressor, the complete sync pulse train from this circuit is also applied to the first valve in the frame waveform section. This has a delay line in its anode circuit which causes the valve to function as a frame pulse separator. The broad pulses which constitute the frame pulse in the broadcast waveform have superimposed on them reflected pulses from the delay line, but the narrow line sync pulses have not. The output from the first stage is fed to a limiter valve which conducts only in response to the superimposed pulses. Anode current, therefore, only flows when the frame sync pulse occurs.

The output signal from the limiter is applied to a differentiating circuit and the differentiated pulse is used to fire a blocking oscillator valve. This discharges a capacitor which is charged through a resistor during the interval when the valve is blocked. The capacitor is connected in series with a variable resistor which produces the interruption in the frame scanning signals of Fig. 2 (a). The waveform set up at the anode of the blocking oscillator valve is linearized in a shaping circuit and is finally applied to two cathode follower stages. A common cathode resistor functions as a combining resistor for the cathode follower output stages of the line and frame sections.

A low pass filter connected between the line output stage and the modulator input cuts off in the region of 300 kc/s, and its function is to prevent high harmonics of the line scanning signals from beating with the scanning carrier. A low pass filter following the frame output stage cuts off in the region of 3 kc/s and prevents line signals from passing into the frame circuits.

The combined line and frame scanning signals are now fed to the cathode of an amplifier valve. The output from this stage is connected to the suppressor of a modulator valve which has a carrier oscillation at 984.7 kc/s applied to its grid. This is derived from a conventional crystal oscillator. The scanning signals fed to the suppressor of the modulator valve are of such an amplitude that the anode current is cut off during the interruption in the frame scanning signal. In this way the line scanning signals are suppressed during the flyback time.

The output of modulated carrier frequency signals from the modulator valve is fed by a transformer to an r.f. amplifier stage. The output signal is developed across a tuned circuit which forms part of a wide band filter network. A fraction of this output is taken from a tapping point of the circuit and is applied by a capacitor and inductance to the input of a cathode follower and to a diode. These circuits constitute a π-type filter whose output is rectified by the diode. The load circuit of this diode comprises a low pass filter, the output of which is fed to the control grid of the modulator input valve. The signals fed to this valve are modulation frequency components which provide negative feedback, thereby linearizing the modulation process.

A low pass filter prevents feedback of carrier frequency signals and its pass band is approximately that of the modulation frequency band. The filter begins to attenuate at about 50 kc/s, and the reduction of negative feedback at these frequencies gives pre-

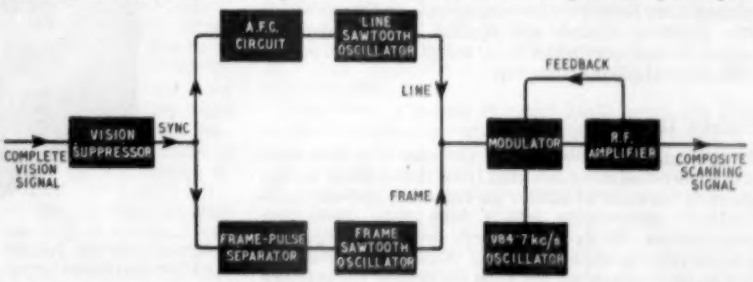


Fig. 3. Simplified block schematic of the waveform generator at the sending installation.

Racks of equipment at the sending installation.

emphasis of the higher frequency components of the line scanning signals. This produces the ripple shown in Fig. 2 (b). A series capacitor reduces the feedback at low frequencies and produces the upward curvature of part of the frame scanning signal in Fig. 2 (a).

The pre-emphasis in the wave shape Fig. 2 (a) of the frame waveform serves to correct for the finite inductance of the practical transformer in the receiver circuit, Fig. 1. The ripple in the line scanning waveform Fig. 2 (b) serves two purposes. It enables more effective use to be made of the scanning carrier and sharpens the cut-off of the KT36 in Fig. 1 produced by the waveform interruption. A sharp cut-off is required to permit the production of high e.h.t.

The ripple in the waveform does not produce "banding" in the picture since it exists only at a time when the KT36 is taking grid current. By virtue of the filters R_1C_1 and R_2C_2 in Fig. 1 the whole of the scanning signal waveform is integrated in the capacitor C_1 (the effective capacitance of all the capacitors in the grid circuit to earth), the line signals having negligible effect on the voltage across it.

The scanning signals from the waveform generator are amplified to a 9-watt level and applied to a low pass filter. Vision signals after demodulation are re-modulated on to a 5.42-Mc/s carrier wave; these signals need contain no sync pulses. They are also amplified to a 9-watt level and are fed through a combining filter network which includes a section to which the scanning signals are applied. The composite signal is then combined with sound signals at service level and applied to the line.

Safety Devices

Under fault conditions or at the end of a broadcast a d.c. potential is transmitted from the sending equipment to take out of circuit all repeaters and any subscribers' equipments which may have been left switched on. At the subscriber's premises it operates a small relay in the control box. Another safety device is a resistor connected between the grid of the receiver c.r. tube and true earth which serves to inject a considerable hum into the picture if the subscriber has inserted his mains plug so that the chassis is connected to the live conductor instead of to neutral.

The receiver in Fig. 1 requires at least a 100-mV vision signal and a 200-mV scanning signal. As the sending equipment produces a 30-volt vision signal the total insertion loss must not exceed 50 db. The total effective attenuation of an equalized network using 22 s.w.g. cable is approximately 4 db per 100 yards, which may be taken to include the insertion loss of other subscribers. In the spur cable to the subscriber's down lead transformer, 14 db is the minimum attenuation that can be tolerated without producing a noticeable mismatch. The balance of 36 db may be shared between the transfer loss of the main feeder to spur transformer and the effective cable attenuation. Assuming a transformer loss of 16 db, the remaining 20 db may be accepted as the cable attenuation of a 500-yard cable run and at least six repeaters would be necessary to cover a square mile area.

If the terminal unit sensitivity was 10 mV (on vision) the planning loss would be 70 db and the cable run could be extended to 1,000 yards. At least two repeaters would be required to cover a square mile area. The purpose of this calculation is to show that there must be a cost compromise between terminal unit simplification and the number of repeaters required in a given area.

Higher Sensitivity Receivers

The position is further complicated by the fact that if the number of subscribers is low the cost of the repeaters becomes the limiting factor. One solution is to adopt the 70 db planning figure, which entails the use of receivers with 10-mV sensitivity over part of the area, and then use low-sensitivity receivers in

Repeater station for use with the distribution system.

the area close to the repeating equipment. A 5-valve receiver was used in North London in a field test of the system and this had a maximum sensitivity of 5 mV at vision frequencies. A receiver of this sensitivity was chosen because it was most likely to indicate the degree of interference from all sources.

The equipment field tested was primarily designed for single-channel operation. A number of proposals have been made for multi-channel operation. The latest high-grade cables have a cross-talk factor of the order of 50 db at 5.42 Mc/s at the end of a 1,000-yard run and are very similar to existing cables, although manufacturing tolerances have been reduced. A modification of the present system for multi-channel operation uses cables of this type. It employs quadrature transmission of vision and scanning signals in such a way that the resulting cross modulation takes the form of an interfering phase modulation of the desired signal. The effect of this phase modulation is negligible.[2]

All network transformers and equalizers in the system described cover a band between 0.7 Mc/s and 6.5 Mc/s. It is possible that the vacant band between 1.2 Mc/s, the top end of the scanning signal spectrum, and 2.7 Mc/s, the lower end of the vision signal spectrum, could be used later for colour television.

Finally, I wish to thank the engineers of E.M.I. and B.R.S. whose co-operation has made possible the practical investigation of this type of wired television distribution system.

[2] British Patent Application No. 14511/54.

Lacquer Film Capacitors

Development of Sub-Miniature Units for Use with Transistors

EXTREME miniaturization of capacitors for low-voltage operation for use in equipment employing transistors depends to a large extent on the ability to produce very thin dielectric films which are strong enough to withstand the various processes involved in the manufacture of capacitors.

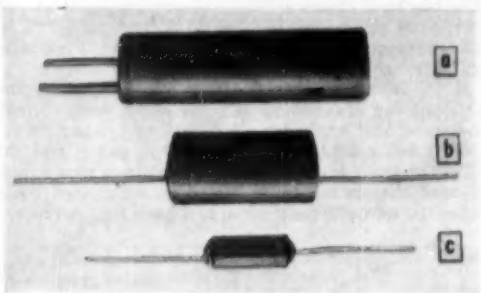
Ceramics of very high dielectric constants, say of several thousand, offer only a partial solution since there are practical limitations to the extent to which such materials can be reduced in thickness and still be usable in capacitors. Generally speaking the upper capacitance limit is about 0.01 μF for this type of capacitor, so where larger capacitances are required the wound type, typified by the rolled-paper and metal-foil pattern, offers many advantages.

Recently some work has been done in the Bell Telephone Laboratories in America on the production of extremely thin lacquer films suitable for use in the manufacture of the wound type of capacitor. A paper published in the December, 1954, *Proc.I.R.E.* under the title "Miniature Lacquer Film Capacitors" gives some interesting details of the method employed and of the characteristics of the sub-miniature low-voltage capacitors developed by this means.

The lacquer films are normally too fragile to be self-supporting and to withstand the metallizing, trimming and other processes entailed in the manufacture of the capacitors. The film is therefore formed on a supporting base, or carrier, and remains so supported right up to the final winding process.

The carrier, for which ordinary capacitor paper tissue may be used, is first coated with a "parting layer," the purpose of which is to enable the processed lacquer film to be separated easily from the carrier when the time arrives. If a carrier were used from which the film would naturally strip easily then there would be no need for a "parting layer." When employed, the "parting layer" must consist of a material which is not attacked appreciably by the solvent of the lacquer, or by the lacquer itself.

After depositing the lacquer film on the prepared carrier, it is metallized and the strip is trimmed and cut to the width required. During the final winding process the processed film is separated from the carrier by winding the film on to the capacitor mandrel and the carrier on to another mandrel of the same winding machine.



Steps in the miniaturization of capacitors. All units are 2 μF and (a) is paper and metal foil construction, (b) is metallized paper and (c) is the new metallized lacquer film type. The largest capacitor is 2¼ in long.

Assuming a lacquer film 0.1 mil (one ten-thousandth of an inch) thick is used, it is said to be possible to produce a metallized lacquer film capacitor for low-voltage operation which is only 1/6 to 1/7 the size of the smallest metallized-paper type of the same capacitance.

The illustration, taken from *Proc.I.R.E.*, shows some recent advances in miniaturization of capacitors. All units are of 2 μF capacitance and (a) is an early style made from two layers of 0.3-mil paper and aluminium foil, (b) is a 0.3-mil metallized paper capacitor and (c) is the 0.1-mil metallized lacquer-film type described here.

Tests over a period of some 2,000 hours are said to show satisfactory stability for this style of construction, while during the tests a counter circuit detected only a small number of punctures, which, incidentally, are self-sealing as with the metallized-paper type of capacitors. This was with a test voltage of 120 V d.c.; with 80 V d.c. all dielectric break-downs were eliminated so that 50 V d.c. would be a conservative rating for this type of capacitor. It will satisfy all or most present requirements of transistor circuitry.

RECORDING TOPICS

Some Factors Influencing the Quality of L.P. Discs

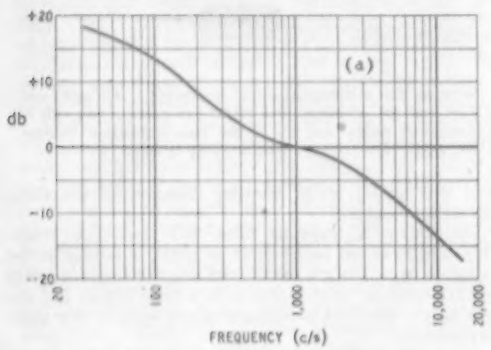
By O. J. RUSSELL, B.Sc., A.Inst.P.

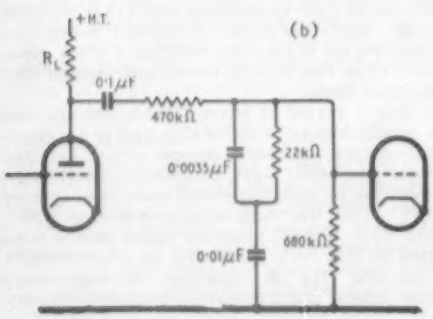
FROM correspondence arising out of my recent comments on recording matters[1], several interesting points have arisen. Accordingly something of a rider to the previous article appears in order, particularly as interesting information has been supplied by a professional recording engineer, who wishes to remain anonymous.

The first happening of interest is that many firms are adopting a standard playback characteristic. This characteristic, which is not very different from the old A.E.S. playback curve previously given, will be variously known as the "new" A.E.S. curve, the NARTB curve and the R.C.A. "Orthophonic" curve. The playback characteristic is shown in Fig. 1(a), and it is very similar to the "old" A.E.S. curve. Suitable compensating circuits are given in Figs. 1(b) and (c).

This is a valuable measure of standardization, although not as complete as some might wish. Briefly the curve will apply for all American l.p. and "s.p." (78 r.p.m.) recordings, but the EMI group and the Decca group it is understood will continue to use their present characteristics for 78-r.p.m. recordings while using the new playback curve as a basis for l.p. recordings. No agreed "zero hour" exists for this changeover, and in fact some firms made the change in December, 1954; during 1955 most of the others will have followed suit. As the new playback characteristic (like the earlier A.E.S. curve) is virtually a "universal" curve, it does in fact compensate satisfactorily for almost all l.p. characteristics previously employed, and also for 78-r.p.m. records employing "top boost," with the possible exception of the Decca "ffrr" 78-r.p.m. characteristic. Thus a single fixed equalizer can be employed in the U.S.A., and with an adjustable tone control would suffice for British records with the exception of some pre-war recordings. However, many virtuoso pre-war recordings have been re-issued in l.p. form, and the recent drastic removal of many noteworthy pre-war recordings from the 78-r.p.m. lists may be an indication that these may be dubbed on to l.p. discs.

Considerable numbers of pre-war recordings have already been dubbed on to l.p. records. The frequent observation that the l.p. dubbing supplies superior quality to the original pressings has been explained by my professional informant. The l.p. discs are frequently made by playing back the actual 78-r.p.m. metallic positives ("mothers") when resurrecting pre-war and pre-tape recordings. Some imperfections of early types of cutting heads may be electrically compensated in the process, and the final l.p. pressing, due to improvements in techniques, may frequently be of superior quality to the original 78-r.p.m. pressings. The very low compliance of the metallic "mothers" increases the frequency of the upper pickup resonance, so that there is presumably less difficulty in extracting high frequencies from the "mother" during the dubbing process. Incidentally, experiments in dubbing from early acoustic "mothers" has shown that frequencies thought to be above the top frequency limit of the acoustic recorders can be recovered. Dubbing has clearly advanced from the days when





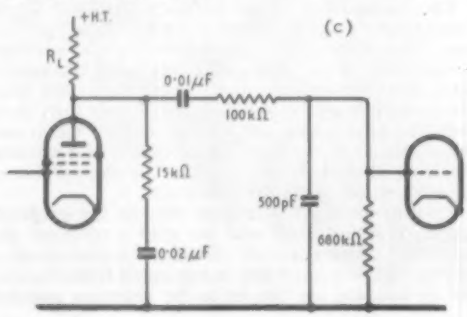


Fig. 1(a) New playback characteristic for long-playing records, with appropriate filter couplings to follow (b) a triode and (c) a pentode.

wax cylinders were duplicated by a pantograph process, although the process described above is basically a mechanical pantograph process electronically refined!

Incidentally, in the past "masters" were burnished, and it has been stated that this burnishing or "polishing" process, while only slightly increasing harmonic distortion, may greatly increase intermodulation distortion.[2] Considerable success in the restoration of early recordings has been obtained when unpolished masters are available.

In view of the many complex processes intervening between the original tape recording and the finished pressing, it is something of a miracle that modern recordings are generally of such superlative quality. Music in particular is a singularly difficult commodity to "can" to the satisfaction of musicians, technicians and critics simultaneously. The added difficulties of l.p. microgroove techniques have in fact resulted in considerable numbers of recordings suffering from technical blemishes. As might be expected the closer groove spacing renders l.p. discs particularly vulnerable to "pre-echo" due to heavy groove modulation distorting the adjoining outer groove, and thus producing the effect of a "pre-echo" as a faint impression of the sound is heard when the stylus traverses the distorted groove preceding the heavily modulated groove. The longer time delay between grooves due to the slower rotation of l.p. records gives the "pre-echo" a better chance of being heard, as it may coincide with a quiet passage prior to a violent crescendo.

Tape Joins

The impact of technical factors at every point in the overall recording process upon musical quality does not appear to be appreciated in some quarters. However, many technical blemishes in records appear to be directly attributable to the master tape. Tape joins are a particular *bête noire* of the reviewers. Briefly, they account for abrupt changes in quality, noise level, volume and pitch. While tape is a very suitable medium for long continuous recording, it should be noted that for the master tapes a speed of 30 inches per second is used. Thus a 3,600-ft spool lasts just over twenty minutes, and consequently tape joins are frequently inevitable in practice. Abrupt changes are frequently noticeable at tape joins in the finished l.p. discs. An even more horrifying possibility is the allegation that repeats in classical works are sometimes faked by merely playing the tape through again.[3]

Even harsher accusations against recording practices have been made[4], and it is certainly true that the control engineers play a very important role in the recording process. A simplified diagram of the overall process from studio to the lacquer "cut" is shown in Fig. 2. The acoustic properties of the studio may be adjusted by the use of screens and absorbers, a process in which the recording artists may be expected to have very definite ideas. Pick-up of sound and balancing of orchestral sections may be by the use of several microphones, three to twelve being quite usual. One American recording concern, however, uses only a single microphone for many of its classical recordings. The microphone inputs are individually equalized, mixed and passed through a variable equalizer into a tape recording and playback unit. The microphone outputs are mixed and the variable equalizer adjusted by the engineer until the replay

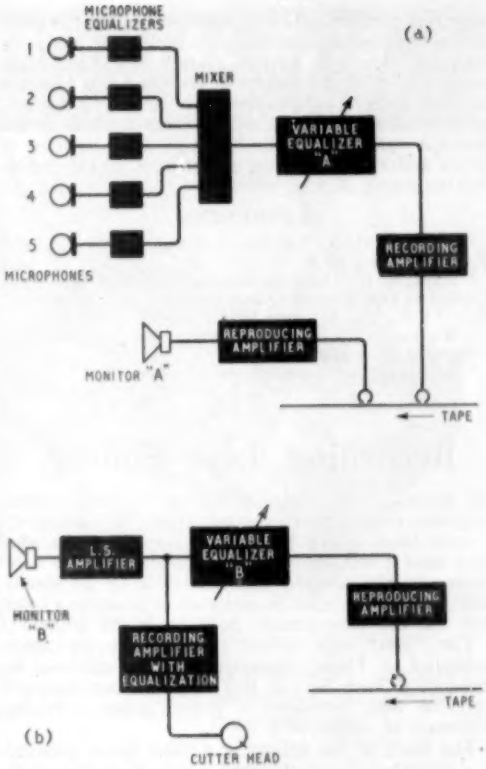


Fig. 2 Stages in the production of a lacquer "cut"; (a) recording the tape master, (b) transcribing from tape to disc.

speaker "A" gives the desired balance in its own particular acoustic environment. While the environment will usually be a familiar one, it may well be a totally unfamiliar one such as the ante-room of a foreign concert hall or theatre.

The lacquer "cut" is made by playing back the edited tape recording, and generally a different machine and a different monitor speaker "B" in a different acoustic environment will be used. A playback equalizer is used, and generally a disc is cut without need for adjustment of the playback equalizer, although tapes from machines of different characteristics may require equalizing adjustments. When a satisfactory playback is achieved, the lacquer disc is cut via a recording amplifier also incorporating an equalizer. Unfortunately, this equalizer cannot be designated as a "black box" imposing the "recording characteristic," tempting as such a description would be.

Indeterminate Variables

It is clear that so many variables are present, including those variables of the "personal equation" type, that it is pointless to argue over a decibel or two at the extremes of the audio spectrum. This is quite apart from such technical variables as high-frequency playback loss which also enter the picture. Moreover, with the additional technical processes in-

volved in producing the finished pressings, it is clear that perfection in recordings is not easily achieved. Contemplating the overall system from recording studio to the home listener's loudspeaker it is frustrating that overall negative feedback cannot be applied. At present negative feedback is only applied in the broadest cybernetic sense through the activities of critics and the purchasing preferences of the public and the depth of their pockets.

REFERENCES

[1] RUSSELL, O. J., "Stylus in Wonderland." *Wireless World*, October, 1954.
[2] ROYS, H. E., "Intermodulation Distortion Analysis as Applied to Disc Recording and Reproducing Equipment." *Proc. I.R.E.*, Vol. 35, page 1149 (October, 1947).
[3] WARRACK, J., "Chamber Music for All." *Daily Telegraph*, November 8, 1954.
[4] Editorial, *The Gramophone*, October, 1954.

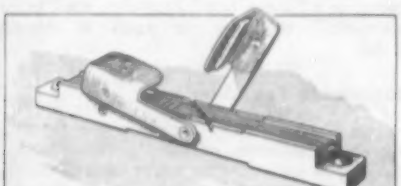
Recording Tape Splicer

IN theory it is a simple matter to join broken magnetic recording tape, using a pair of scissors or a razor blade and a bit of sticky tape. Those who have tried it will know that in practice it can be very fraying to the temper, and that it is by no means easy to align the ends properly or to produce a joint that will not subsequently hold up in the guides.

The "Bib" tape splicer produced by Multicore Solders, Ltd., Hemel Hempstead, Herts, and used in conjunction with Scotch Boy No. 41 "non-oozing" adhesive tape, produces a perfect joint with the minimum of effort.

The body of the splicer is a brass block grooved to a clearance fit for standard ¼-inch tape, with cork pressure pads on hinged arms located to hold the ends firmly in line. A transverse slot at an angle of about 60° is provided to guide the cutter when making the scarfed joint, and parallel slots at the edges of the tape guide ensure that the joint is reduced slightly in width when trimmed—actually by the thickness of the razor blade if it is held vertical. Although not mentioned in the instructions, we found that it was important to make the direction of each trimming cut towards the tapering point on each side, otherwise there was a tendency to pull the extreme point out of the joint slightly. With this precaution a perfect splice was obtained every time.

The retail price of the "Bib" splicer is 18s 6d. It is supplied on a flock-sprayed wooden base, but can be removed from this and attached directly to the recorder deck by two screws, if desired. The instruction leaflet contains useful general hints on tape editing.



"Bib" splicer for use with ¼-in standard magnetic recording tape.

Transistorized Telephone

SHOWN in the illustration is a telephone handset fitted with a microphone designed for use in very noisy locations. It responds only to sounds originating close to the mouthpiece; in consequence, the output is much too low for its use in ordinary telephone systems without pre-amplification.

An amplifier designed around Mullard junction transistors is shown. It comprises two stages for bringing the output of the microphone up to the normal level and a third to give further amplification where a high noise

Noise-cancelling telephone and transistor amplifier.

level prevails at both ends of the line. The amplifiers are operated from hearing-aid type batteries in the plastic tube on the right of the unit.

As transistor equipment can, where necessary, be made very small the amplifier could be incorporated in the handset itself and powered by the low-voltage supply of the normal telephone system.

Commercial Literature

Band III Television Converter with station selector switch, on/off mains switch (which also controls the main receiver) and Band-III station tuning control. May be operated with either a.c. or a.c./d.c. receiver and power consumption is 10 watts. Also a **Television Pre-amplifier**, a **Distribution Unit**, and a **Multi-outlet Box.** Leaflets from Aerialite, Castle Works, Stalybridge, Cheshire.

Oxidation Insulation for closely spaced wire-wound resistors. A new process giving a coating of good insulating properties to the nickel-chromium-iron alloy "Brightray B," described in a leaflet from Henry Wiggin & Company, Wiggin Street, Birmingham, 16.

Capacitance Meter with range of 0-250pF and facilities for measuring stray capacitances *in situ*. Frequency modulation of a transitron oscillator is changed by capacitance to be measured and the change is detected by a linear discriminator. Also an **A.C. Voltage Regulator**, an **Oscilloscope Camera**, a **Cathode Follower Unit** and various **Pressure Transducers.** Leaflets from J. Langham Thompson, Bushey Heath, Herts.

Arc Soldering Iron with one electrode formed by hollow carbon bit and the other by resin-cored solder fed through the centre of it. Contact with work completes the circuit, forms an arc and melts the solder. Current supplied from 4-V or 6-V battery or transformer. Description on a leaflet from C. J. Casey (London), 49, St. James's Street, London, S.W.1.

Test Gear and Electronic Instruments. Services offered by Livingston Laboratories as agents for a large number of different makes are explained in a booklet "What We Can Do For You." From Livingston Laboratories, Retcar Street, London, N.19.

NEW!

EXPERIMENTAL KITS in Radio, T.V. etc.

LEARN THE PRACTICAL WAY

Specially prepared sets of radio parts with which we teach you, in your own home, the working of fundamental electronic circuits and bring you easily to the point when you can construct and service radio sets. Whether you are a student for an examination; starting a new hobby; intent upon a career in industry; or running your own business—these Practical Courses are intended for YOU—and may be yours at very moderate cost.

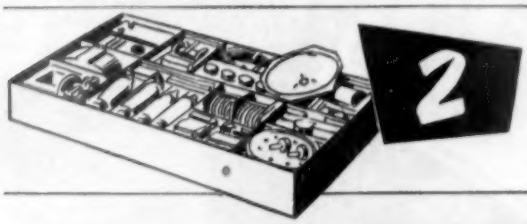
EASY TERMS FROM 15/- A MONTH

With these outfits, which you receive upon enrolment, you are instructed how to build basic Electronic Circuits (Amplifiers, Oscillators, Power Units, etc.) leading to complete Radio and Television Receiver Testing and Servicing.

1

BEGINNER'S RADIO OUTFITS — For carrying out basic practical work in Radio and Electronics, from first principles and leading to the design and building of simple Receivers.

ALL EQUIPMENT SUPPLIED IMMEDIATELY AND REMAINS YOUR PROPERTY

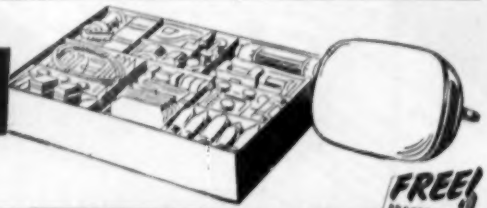


2

ADVANCED RADIO OUTFITS — With this equipment, you are instructed in the design, construction, testing and servicing of complete modern TRS. Superhet Radio Receivers.

TELEVISION Outfit No. 3 — With this equipment you are instructed in the design, construction, servicing and testing of a modern high-quality 15" Television Receiver.

3



FREE! PROSPECTUS

OTHER COURSES WITH EQUIPMENT INCLUDE:

MECHANICS · ELECTRICITY
CHEMISTRY · PHOTOGRAPHY
CARPENTRY

ALSO DRAUGHTSMANSHIP · COMMERCIAL ART
AMATEUR S.W. RADIO · LANGUAGES · ETC.

POST THIS COUPON TODAY

Please send me your FREE book on Practical Courses.

Subjects of interest _____

To: E.M.I. INSTITUTES, Dept. 127k, Grove Park Road, London, W.4.

NAME _____

ADDRESS _____

_____

E.M.I. INSTITUTES The only Postal College which is part of a world-wide Industrial Organisation

ICS7

SenTerCel H.T. rectifiers
from 125V 30mA
to 250V 300mA
Specially designed for use in domestic Radio & Television receivers, these miniature rectifier stacks have an established position with manufacturers to whom reliability, small dimensions and low costs are important.
FEATURES
Instant starting — no warming-up period
Unlimited instantaneous overload
No limit to size of reservoir capacitor
Simple mounting—no valve holder
Withstand overloads such as charging current of de-formed electrolytic capacitors
Low heat dissipation
Practically indestructible in service
Simple wiring—two connectors only
Small size . . . low weight
Low cost
TYPE | RM0 | RM1 | RM2 | RM3 | RM4 | *RM5
Maximum ambient temperature | 35°C 55°C | 35°C 55°C | 35°C 55°C | 35°C 55°C | 40°C 55°C | 40°C 55°C
Maximum output current (max.) | 30mA 15mA | 60mA 30mA | 100mA 60mA | 120mA 90mA | 250mA 125mA | 300mA 150mA
Maximum input voltage (r.m.s.) | 125V | 125V | 125V | 125V | 250V | 250V
Maximum peak inverse voltage | 350V | 350V | 350V | 350V | 700V | 700V
Max. instantaneous peak current | Unlimited | Unlimited | Unlimited | Unlimited | Unlimited | Unlimited
Weight | 0.82 oz. | 1 oz. | 1.4 oz. | 2 oz. | 4.5 oz. | 4.75 oz.
*For use in voltage doubler circuits the peak inverse and maximum input voltages are halved, current output being as for half wave operation.
SELENIUM
SenTerCel
RECTIFIERS

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2

RECTIFIER DIVISION: Edinburgh Way, Harlow, Essex. Telephone: Harlow 26811

Gramophone and Microphone Pre-Amplifier

Concluded from page 14 of January, 1955, issue

Constructional Recommendations: Test Procedure

By P. J. BAXANDALL, B.Sc.(Eng.)

IN building the pre-amplifier, there are several practical matters which must receive attention if first-class results are to be obtained.

To keep the hum level in the input stages as low as possible, the following recommendations should be adopted:—

(a) The wiring, particularly that associated with the grid and cathode circuits, should be arranged so as to avoid forming loops of large area, since hum voltages of appreciable magnitude can be induced in such loops by stray 50-c/s magnetic fields from nearby mains transformers, etc. A good layout for the microphone and mixer stages is shown in Fig. 8.

(b) The valveholders for the EF86's should be made of high-grade dielectric material, ordinary Bakelite being liable to introduce appreciable coupling between heater and grid pins; the holders made by Ediswan-Clix in p.t.f.e. are suitable. (The advent of all-glass valves such as the EF86, with the grid pin diametrically opposite the heater pins and with internal shielding between them, together with special valveholders, has made it possible to obtain extremely low hum levels even when the grid-circuit impedance is high, so that the advice given by the author in an earlier article,[1] always to use top-grid valves for such applications, may now be regarded as out of date.)

(c) Heater wiring should be twisted and the chassis should not be used as a return lead for heater current. Stray capacitance between the heater leads and grid circuit wiring should be kept as small as possible, a good arrangement being to run the heater supply along the top of the chassis, taking each heater feed down through a hole in the chassis near the valveholder but diametrically opposite the grid pin.

(d) A common heater supply may be used for all

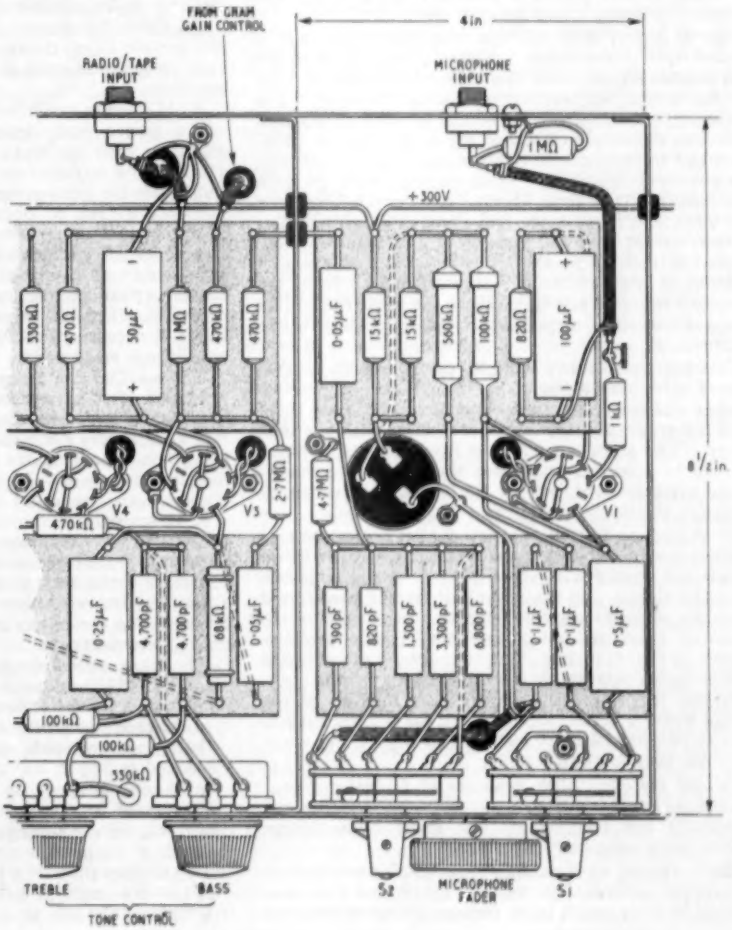


Fig. 8. Underside view of part of the chassis, showing a suitable layout for the microphone and mixer stages.

valves, and should have either a fixed centre-tap, connected to chassis, or, alternatively, a "hum-dinger" potentiometer, of value about 100Ω, whose slider is connected to chassis. A fixed centre-tap should be quite satisfactory if all other precautions have been taken, but a potentiometer has the advantage of enabling the hum on one particular input stage to be reduced to a specially low value if and when required. (The application of a d.c. bias voltage to the heater supply, as recommended in an earlier article,[14] is unnecessary with moderrn valves such as the EF86, which have been specially designed for input stages.)

(e) The whole pre-amplifier circuit should be electrostatically screened, by mounting in a metal cabinet or by fitting a base-plate to the chassis.

(f) If a microphone input transformer is used, it should be enclosed in a Mumetal screening box. (The "Bi-limboid" series of astatic input transformers, made by Wright and Weaire Ltd., may be recommended; their hum-cancelling properties enable a screening box to be dispensed with under some circumstances, but when used in conjunction with ribbon microphones, it is usually desirable to employ a screening box.)

Some further practical points, relating to matters other than hum, are as follows:—

(g) It is very desirable that when one input stage is faded right down, but is receiving a large input signal, no audible signals from this channel shall get through to the output *via* unintentional stray couplings. For example, a fraction of a picofarad of stray capacitance between the anode circuit of the input stage in question and the grid circuit of the mixer stage, is sufficient to give very appreciable break-through with the gain control set to zero. Stray capacitance coupling between one input stage and another gives a similar result, except that the volume of the break-through sound is then dependent on the setting of the gain control of the "receiving" stage. In both cases the sound is thin and screechy, due to the greater effectiveness of the stray capacitance coupling at high audio frequencies.

To avoid the above trouble, the components associated with one input stage should be grouped together and a screening partition placed between them and the group of components associated with the next stage. The signal-output lead from each input stage should be screened and taken through to the mixer-stage compartment, where the 470-kΩ mixer-input resistors should be mounted.

(h) A further desirable feature is that no appreciable clicks should be heard on operating the switches associated with the low-pass filter or the microphone bass-cut circuit. In the latter case, it has been found that the main precaution necessary is to mount the bass-cut capacitors on a separate group board, as shown in Fig. 8; if they are mounted on a group board which also contains components having applied d.c. voltages, the slight leakage currents flowing in the group board are sufficient to cause the unused capacitors to become charged, resulting in large clicks when they are switched into circuit.

In the low-pass filter, resistors of 10 MΩ are connected across the switch contacts to ensure that the capacitors are charged to the appropriate voltage before being switched into circuit.

With regard to the general form of construction, the simple scheme depicted in Figs. 8 and 9 is considered to have much in its favour, though the size of the unit could certainly be reduced by adopting a more advanced layout. Due to the use of miniature valves and double electrolytic capacitors, the overall size is, however, small enough for most applications.

For applications where all the facilities given by the circuit of Fig. 1 are not needed, some of the following simplifications may be made, with consequent reduction in cost:—

(a) Adopt triode connections permanently in the microphone input stage; the gain will then be fully sufficient for all normal purposes when a good moving-coil microphone is used, and enough for many purposes using a ribbon microphone. (Connect anode to G_2, G_3 to cathode, and make the anode load and cathode bias resistors 100 kΩ and 1 kΩ respectively.)

(b) Omit the bass-cut circuit in the microphone stage, or provide a smaller number of positions.

(c) Omit the gramophone input stage. and employ a crystal pickup feeding directly to the mixer stage.

(d) Use the two halves of an ECC81 (12AT7 or CV455 are equivalent) for the mixer and tone-control stages. The anode loads should be 68 kΩ and the cathode-bias resistors 680Ω. Occasional samples of this valve may possibly be too microphonic[6], but, in view of the reasonably high signal level, little trouble is likely to be experienced.

(e) Omit the master gain control at the output of the pre-amplifier; the facility it provides for fading out two programme sources simultaneously may not be needed.

(f) If the pre-amplifier is to be operated exclusively off a power pack separate from that in the main amplifier, only one stage of decoupling is necessary in the h.t. feed to each input stage. (It is possible, provided suitable precautions are taken with regard to layout and wiring, to obtain a satisfactorily low hum level even if the power pack is built on the same chassis as the pre-amplifier; in particular, the mains transformer should be mounted as far from the input stages as possible and non-magnetic chassis material is desirable. Trouble from hum is, however, much less likely if a power pack well separated from the pre-amplifier is employed.)

Tests.—The circuits employed in this pre-amplifier are such that no critical adjustments are normally required in order to obtain the desired performance; but, as with any electronic equipment, it is quite possible that—due to faulty components, wiring errors or unsuitable layout—the correct result may not be obtained straightaway.

It is strongly recommended that, no matter what other tests the reader may wish to make, the first test should be to measure various d.c. voltages with a high-resistance meter such as an "Avometer" Model 8. If a meter of lower resistance be used, allowance should be made for the reduction in voltage caused by connecting the meter.

The h.t. supply voltage should be within the limits 270 V to 330 V, and anode and cathode voltages should then be within the following limits:—

(a) Cathode to earth, on all valves: 1.2 to 1.8 V.

(b) Anode to earth, on all valves except output valve: 60 to 150 V.

(c) Anode to earth, on output valve: 80 to 170 V.

If any of the above voltages are found to be dependent on the settings of one or more of the controls, then wrong connections, faulty components or self-oscillation should be suspected, in that order.

If the pre-amplifier has passed the above d.c. tests, it is reasonably safe to assume that the non-linearity

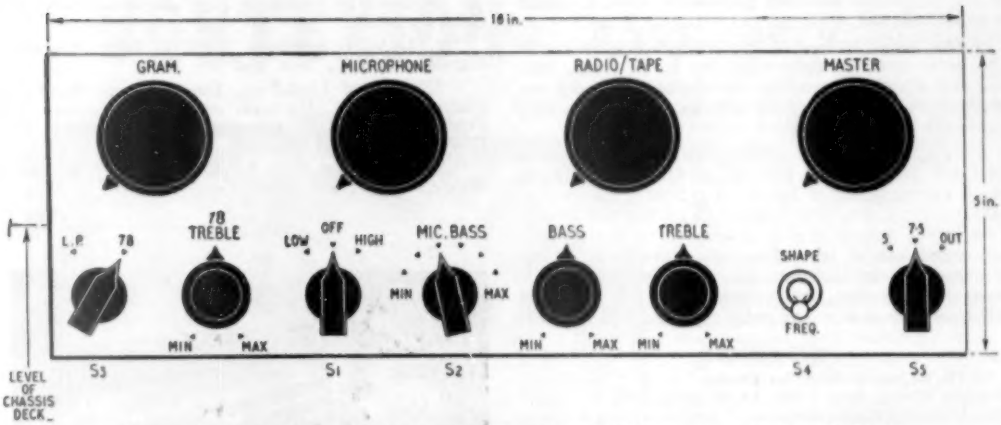


Fig. 9. Suggested front-panel layout corresponding to the under-chassis construction shown in Fig. 8.

distortion will be satisfactorily low and that it will remain low despite normal variations in mains voltage, valve ageing, etc.

Readers possessing, or able to borrow, suitable test gear, will, no doubt, wish to check the frequency response with various control settings. However, the absence of such measuring facilities need not be regarded as an overwhelming handicap, since careful listening tests should be able to indicate whether or not the controls are functioning in approximately the correct ways.

A suitable frequency-response test to start with is to measure the overall response from the microphone-stage input to the final output. The bass and treble tone controls should be set half way between full-lift and full-cut positions, giving a nominally flat response, and the microphone bass-cut and low-pass filter switches should also be set for level response. The effective load on the pre-amplifier output should be 250 kΩ. The overall response curve should then agree with Fig. 7 within ±1 db over the frequency range 40 c/s to 15 kc/s. If satisfactory agreement is not obtained, the responses of the various stages should be measured separately, and the origin of the discrepancy discovered. The following points may be helpful:—

(a) If the two 4700-pF capacitors and the two 100-kΩ resistors in the main tone-control network are perfectly matched pairs, the gain from the mixer stage input to the tone-control stage output will normally fall by a fraction of a decibel as the frequency is raised from about 400 c/s to about 4000 c/s. Such a small change in gain is really quite unimportant, but it may be eliminated if the 100-kΩ resistor between the mixer valve anode circuit and the 1 MΩ bass-control potentiometer is reduced in value by an amount equal to the effective output impedance of the mixer stage, this impedance being just under 10 kΩ when two input stages are employed. In practice, due to the effects of component tolerances, the fall in gain between 400 c/s and 4000 c/s may appreciably exceed 1 db, or it might conceivably be a rise rather than a fall; in either case the remedy is to shunt an extra resistor across the appropriate 100-kΩ resistor in the tone-control network.

(b) The frequency response of the mixer stage, when not connected to the tone-control stage, should be flat within a fraction of a decibel up to 15 kc/s. If the response falls off appreciably at the top end, the cause is almost certainly the existence of too much stray capacitance across the 2.7-MΩ feedback resistor; 4 pF would be sufficient to give a loss of 3 db at 15 kc/s. It is not difficult to arrange the wiring so that the stray capacitance across this resistor is kept down to 1 pF, in which case the top loss will be quite negligible. If, due to unsuitable layout, it is found to be impracticable to obtain a low enough stray capacitance, the resultant top loss may be approximately compensated by connecting a small capacitor across each of the mixer input resistors.

(c) Effects of a similar nature to the above can occur in the output stage, and the wiring should be arranged so as to keep the stray capacitance between anode and grid circuits to a minimum.

(d) The frequency response of the output stage in the 30-c/s to 60-c/s region (see Fig. 7) may be adjusted slightly, if necessary, by altering the value of the 8.2-MΩ feedback resistor.

(e) The frequency response of the gramophone input stage, on the "78" setting of S3, may be adjusted, over a region similar to that mentioned in (d), by changing the value of the 6.8-MΩ feedback resistor. In the "LP" (long playing) condition, the response at such low frequencies is determined mainly by the value of the 3.3-MΩ resistor in the network connected to the "LP" contact of S3.

With the pre-amplifier connected to a power amplifier and loudspeaker, and set for a flat frequency response, the Johnson noise at full gain on a microphone channel, with no signal source connected to the input, should be clearly audible all over the room, and should sound louder than the accompanying hum. If the hum level is undesirably high, and if it cannot be satisfactorily minimized with the "hum-dinger" potentiometer, the first thing to do is to find out whether the hum is due to the a.c. heater supply or not; this is easily done by momentarily disconnecting the heater supply—the valves will continue working for a few seconds on their stored heat. No matter what the cause of the hum, a careful consideration

of the principles outlined previously should enable it to be cured.

Acknowledgment.—The manuscript of this article has been carefully scrutinized by E. F. Good, who has also done independent calculations to check the mathematical results. This valuable service is hereby gratefully acknowledged.

Apology.—Since the appearance of the negative-feedback tone control article,[2] in October, 1952, so much correspondence has been received that it has, unfortunately, not been possible to reply to all letters. The writer would like to apologize to the readers concerned and to any others who have been inconvenienced by the fact that, due to unexpected curtailment of spare time, the present article has appeared much later than was originally expected and implied.

REFERENCES

[1] "High-Quality Amplifier Design" by P. J. Baxandall, *Wireless World*, Jan. 1948. (Also appears in a booklet "High-Quality Audio Amplifiers" available from *Wireless World*.)

[2] "Negative-Feedback Tone Control" by P. J. Baxandall, *Wireless World*, Oct. 1952.

[3] "Equipment for Acoustic Measurements—Part 1" by D. E. L. Shorter and D. G. Beadle, *Electronic Engineering*, Sept. 1951.

[4] "New Equipment for Outside Broadcasts" by A. E. Barrett, C. G. Mayo and H. D. Ellis, *World Radio*, July 21 and 28, 1939.

[5] "New Equipment for Outside Broadcasts" by S. D. Berry, *B.B.C. Quarterly*, Summer 1952.

[6] "Newly Developed Amplifiers for the Sound Programme Chain" by S. D. Berry, *B.B.C. Quarterly*, Summer 1954.

[7] "Microphones," B.B.C. Engineering Training Manual, page 29, published by *Wireless World*.

[8] "Radio Designer's Handbook," page 730, fourth edition, published by *Wireless World*.

[9] "High-Quality Amplifier: New Version" by D. T. N. Williamson, *Wireless World*, Nov. 1949.

[10] "Pickup Input Circuits" by R. L. West and S. Kelly, *Wireless World*, Nov. 1950.

[11] "Filters" by "Cathode Ray," *Wireless World*, Jan. and Feb. 1950.

[12] "The Miller Integrator" by B. H. Briggs, *Electronic Engineering*, Aug., Sept. and Oct. 1948.

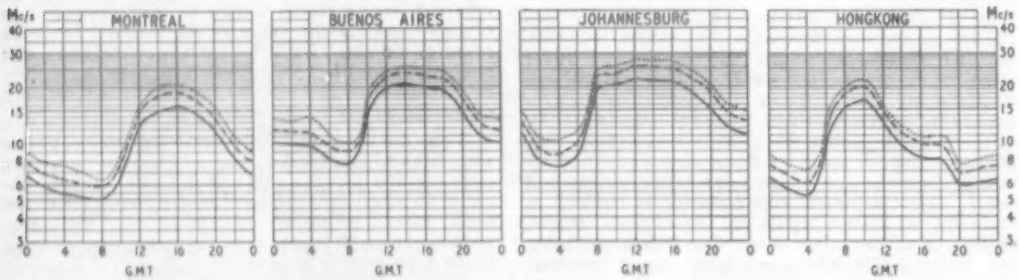
[13] "Design of High-Pass, Low-Pass and Band-Pass Filters Using R-C Networks and D.C. Amplifiers with Feedback" by C. C. Schumard, *R.C.A. Review*, Dec. 1950.

[14] "Hum in High-Gain Amplifiers" by P. J. Baxandall, *Wireless World*, Feb., 1947.

AUTOMATIC SWITCHING. Sound broadcast programmes for the B.B.C.'s West Region transmitters are switched to their destinations by a system something like an automatic telephone exchange. It is operated by a single engineer at this control desk, which is the "nerve centre" of a new control room recently installed at the West Region headquarters in Bristol.

SHORT-WAVE CONDITIONS

Predictions for February



THE full-line curves given here indicate the highest frequencies likely to be usable at any time of the day or night for reliable communications over four long-distance paths from this country during February.

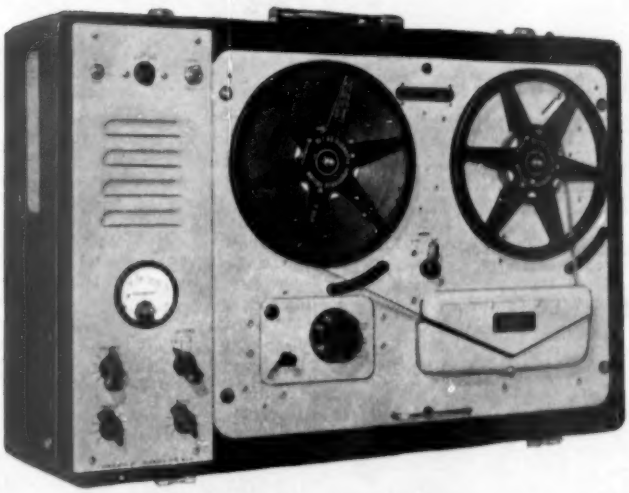
Broken-line curves give the highest frequencies that will sustain a partial service throughout the same period.

..... FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE FOR 25% OF THE TOTAL TIME

— — — PREDICTED AVERAGE MAXIMUM USABLE FREQUENCY

——— FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE ON ALL UNDISTURBED DAYS

VORTEXION TAPE RECORDER



The amplifier, speaker and case, with detachable lid, measures 8¼in. x 22½in. x 15¾in. and weighs 30 lb.

PRICE, complete with WEARITE TAPE DECK £84 0 0

★ The noise level is extremely low and audibly the hum level and Johnson noise of the amplifier and deck are approximately equal. Only 25% of this small amount of hum is given by the amplifier alone.

★ Extremely low distortion and background noise, with a frequency response of 50 c/s.—10 Kc/s., plus or minus 1.5 db. A meter is fitted for the measurement of signal level and bias level.

★ Sufficient power is available for recording on disc, either direct or from the tape, without additional amplifiers.

★ A heavy mu-metal shielded microphone transformer is built in for 15-30 ohms balanced and screened line, and requires only 7 micro-volts approximately to fully load.

★ The .5 megohm input is fully loaded by 18 millivolts and is suitable for crystal P.U.s, microphone or radio inputs.

★ A power plug is provided for a radio feeder unit, etc. Variable bass and treble controls are fitted for control of the play back signal.

★ The power output is 3.5 watts heavily damped by negative feedback and an oval internal speaker is built in for monitoring purposes.

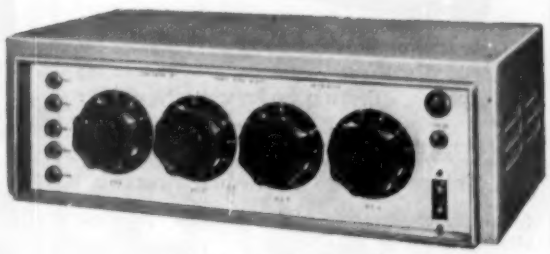
★ Facilities are provided for using the amplifier alone and using power output or headphones while recording or to drive additional amplifiers.

★ The unit may be left running on record or play back even with 1,750 ft. reels with the lid closed.

POWER SUPPLY UNIT to work from 12 volt Battery with an output of 230 v., 120 watts, 50 cycles within 1%. Suppressed for use with Tape Recorder. **PRICE £18 0 0.**

FOUR CHANNEL ELECTRONIC MIXER

is almost essential for the professional or semi-professional where a number of different items have to be mixed on one tape recording.
It is recommended by a number of tape recorder manufacturers for this purpose.
Any normal input impedance can be supplied to order, balanced or unbalanced, the standard being 15-30 ohms balanced.
The normal output is 0.5 volt on 20,000 ohms or less, but 600 ohms is available as an alternative.
The steel stove enamelled case is polished and fitted with an engraved white panel suitable for making temporary pencil notes.
An internal screened power pack and selenium rectifier feed the five low noise non-microphonic valves.
Used in many hundreds of large public address installations and recording studios throughout the world.



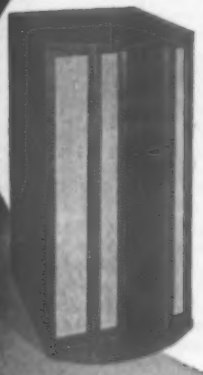
PRICE £36 15 0.

Manufactured by

VORTEXION LIMITED, 257-263, The Broadway, Wimbledon, London, S.W.19

Telephones: LIBerty 2814 and 6242-3 Telegrams: "Vortexion, Wimble, London."

The Cultured Voice of Quality



SOUND SALES
PHASE INVERTER SPEAKER

For its size, this is one of the most attractive loudspeaker combinations I have yet come across . . . " the standard of reproduction obtainable must be heard to be believed." Not only is there a good, clean treble, well distributed by the diffusers on the front of cabinet: there is also a very firm, clear bass which extends below 50 c/s. Clarity is indeed the most noteworthy characteristic of this speaker. It was this quality that impressed itself on several visitors I had on the day when I was putting the speaker through its paces That extra half octave above about 12 kc/s, and the corresponding one below about 30 c/s usually cost an awful lot of money. The range here is audible from below 20 up to above 15,000 c/s !

TECHNICAL REPORT *by P. WILSON, M.A., of " THE GRAMOPHONE"*

Price **£14.10.0**
complete with cabinet

OBTAINABLE FROM ALL LEADING STOCKISTS
WEST STREET, FARNHAM, SURREY Tel.: FARNHAM 6461/2/3

SOUND SALES LIMITED
Manufacturers of Electronic Equipment *Established since 1931*

SHORTAGE OF ELECTRONIC TECHNOLOGISTS

The demand of Industry and the Ministries for our trained students is still far greater than we can supply. For top-grade technologists we offer :

THREE-YEAR COURSE
in Telecommunication Engineering

(provides opportunity for six months' practical attachment)

Next Course commences August 29th

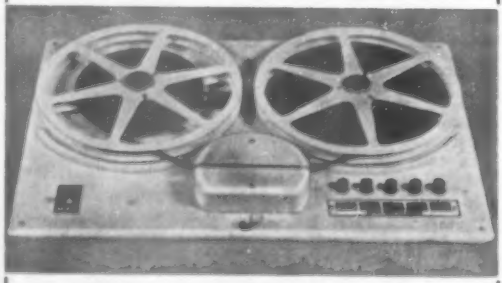
Write for FREE BROCHURES giving details of the above and other day-time attendance courses.

E.M.I. INSTITUTES—the only college which is part of a great industry.

E.M.I. INSTITUTES
DEPT. 12. E.
10, PEMBRIDGE SQUARE, LONDON, W.2
TEL.: BAYSWATER 5131/2

Associated with "H.M.V." MARCONIPHONE COLUMBIA ETC

MOTEK



TWO SPEED—SIMPLE PUSH BUTTON CONTROL

THE NEW K6 UNIT

List Price 19 GNS.

SEE AND HEAR IT AT YOUR LOCAL DEALER

MODERN TECHNIQUES
138-144 Petherton Road, London, N.5
Tel. : Canonbury 5896

Simple Inductance, Capacitance and Resonance Meter

By L. F. SINFIELD

A Useful Adjunct to a Service Signal Generator

THE measurement of small inductors and capacitors for use at radio frequencies is quite a problem, as normally a fairly high degree of accuracy is desired and this entails the use of expensive equipment such as a laboratory universal bridge. Such equipment is certainly not economic if measurements are required only occasionally, as is usually the case.

Although the resonance method does not normally give a direct reading of the inductance it is a simple matter to lay a ruler across a resonance "abac" at capacitance and frequency and read off the inductance. A dynatron, transitron or cathode-coupled two terminal oscillator can of course be used, but even if this will oscillate satisfactorily it is rather cumbersome as it requires valves and power supply, and in any case also requires additional apparatus to measure the frequency.

An adaptor was therefore built to work in conjunction with a signal generator so that the generator would resonate coils with a calibrated capacitor and give meter indication of resonance. It was not expected that any very high degree of accuracy would be obtained, but on test inductors of known values have given readings within limits normally required for this range.

Basically the unit consists of a detector and meter to indicate the signal generator output. The tuned circuit is in series with the meter and its high impedance at resonance gives a dip in the meter current.

The generator used was a cheaper grade "servicing" type, and was modified so that the output was obtained via a cathode follower to give a low-impedance output (about 100 ohms) at maximum output through the entire fundamental range of 100 kc/s to 80 Mc/s. Signal generators using a buffer stage, link-coupled output, or both, will be quite suitable and need no modification.

A germanium diode (GD5-OA61 or other equivalent) provides rectification for the meter which is of approximately 50μA full-scale deflection. The exact sensitivity and calibration of the meter are unimportant as it merely indicates dip. An ex-Government oil temperature meter was adapted by the author, but a centre-zero movement from a visual indicator unit (see *Wireless World*, Sept., 1951) could be used. The meter is by-passed by a 0.1μF capacitor and a further 0.001μF mica type, so that as far as r.f. is concerned the meter and the frame of the 0.0005μF tuning capacitor, as well as one side of the inductor, are all earthy.

Actually the meter can be dispensed with entirely and a pair of phones substituted. The signal generator should then be audio-modulated and the tone will be audible in the phones. The unit is then tuned for minimum audio signal. 100-ohm moving-coil and 4,000-ohm moving-iron phones have been tried and both work satisfactorily, but the high-resistance type gives a louder signal. An ideal arrangement would be to fit a closed circuit jack in series with the meter so that high-resistance phones could be inserted in series with the meter to give indications by either method.

Layout and Calibration

Layout is as shown in Fig. 2 and the overall size about 5in×4in×2¼in. A bakelite panel is used and the whole can be put in a wooden or bakelite box. This is a precaution against increasing the minimum capacity of the tuning capacitor. No trouble has been experienced with hand capacity at any frequency.

Using a known inductance (Wearite PA2-170μH, PA6-37.5μH, PA5-5.5μH) the capacity scale is calibrated. Set the signal input with the generator output control to nearly full scale with the PA2 in place. Set up the following frequencies and calibrate capacitor at each resonant point: 550 kc/s–0.0005μF;

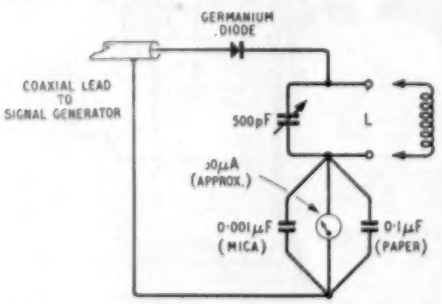


Fig. 1. Basic circuit diagram of inductance capacitance meter.

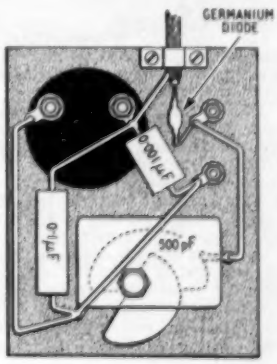


Fig. 2 (right). The layout and wiring are simple. A non-metallic box should be used to keep stray capacitance at a minimum.

610 kc/s - 0.0004μF; 705 k/s - 0.0003 F; 865 kc/s 0.0002μF.

Below 200pF it is advisable to use a coil having a single layer of spaced turns so that the coil capacity will not appreciably add to the main tuning capacity and cause calibration error. Use now the PA5 type coil and set up as before: 4.8 Mc/s-200pF; 5.5 Mc/s-150pF; 6.75 Mc/s-100pF; 7.5 Mc/s-80pF; 8.7 Mc/s-60pF; 10.7 Mc/s-40pF; 15 Mc/s-20pF.

These are the calibration points used on the original and are satisfactory for most purposes. The lower limit may or may not be obtainable as it will vary within capacitor types.

Order of Accuracy

As a test of inductance measurement accuracy a number of known inductance coils were measured with following results.

Coil	Capacitance (pF)	Frequency	Calculated L	Actual L
PA3	200	10 Mc/s	1.23 μH	1.2 μH
PO5	200	5.15 Mc/s	4.7 μH	4.8 μH
PA5	200	4.9 Mc/s	5.2 μH	5.5 μH
PO6	200	2.1 Mc/s	28.0 μH	27.45 μH
PA6	200	1.8 Mc/s	38.5 μH	37.5 μH
PA7	200	630 kc/s	320 μH	310 μH
R.F. Choke	200	225 kc/s	2.5 mH	2.5 mH

The capacitor should preferably be kept at a fairly high value in order to swamp coil self-capacity, provided that adequate dip can be obtained. High values of inductance such as i.f. or long-wave coils, unless pie-wound and of high "Q" may not give a sharp-enough dip for good indication. Also, if such inductors are wound in a single pie the high self-capacity may give a false inductance reading.

It is possible to indicate resonance by either setting a given capacity and varying the frequency or vice versa. If the frequency is varied it is necessary to ensure that the dip is actually a resonance and not a comparatively dead spot in the signal generator output. This can be checked by leaving the generator at that frequency and varying the capacitor, when the dip should again be indicated as the capacity goes through the resonant point.

If the signal generator waveform is not pure and is rich in harmonics there is a probability that the tuned circuit will also resonate at harmonics of the input frequency. The correct actual tuning point is therefore the highest frequency setting of the signal generator at which the dip occurs.

Measurement of small capacitors of up to 480pF is carried out by resonating an inductance with the main tuning capacitor, then connecting the unknown capacity in parallel with the coil and retuning back to the dip. The unknown will then be equal to the difference in the main capacitor settings.

It is not considered that the present layout would permit an exact measurement of inductors of less than 1μH, due to inductance of the internal connections. However, ample dip has been obtained up to the limit of the present set-up (80 Mc/s-20pF-0.2μH). This would indicate an inductance of 0.2μH, but the actual external inductance will in fact be slightly less than this.

MAGNETIC INDUCTION HEADPHONES

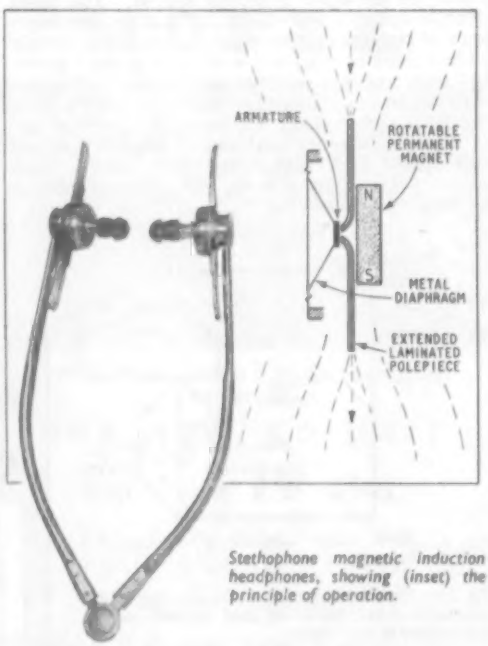
THE method of using a wire loop surrounding a cinema or hospital ward to supply energy to headphones without the inconvenience of connecting leads is by no means new. In general, standard type headphones have been used in conjunction with a small loop to supply them with current by electromagnetic induction.

No electric current is induced in a new type of headphones designed by V. A. Foot, and the forces actuating the diaphragms are purely magnetic. The sketch accompanying the photograph illustrates the principle. Laminated pole pieces of high-permeability material are extended to collect a concentration of flux from the surrounding field, which passes across short air gaps and through a circular armature disc attached to a small conical phosphor bronze diaphragm. As in conventional headphones a polarizing field is necessary, and is supplied by a short permanent magnet which can be rotated to reduce the flux in the air gaps and so to control volume.

The sensitivity is unexpectedly high, and the power required to give good volume in the primary loop surrounding the room is of the order of 10 watts per 1,000 sq ft of floor area.

With no fine wire or wax-impregnated windings to worry about, the phones can be boiled in water or otherwise disinfected, a point which has commended the system to hospital authorities. For hospital use the earpieces are rotatable so that the pole extensions can be kept in line with the vertical magnetic field when the patient is lying down. No volume control is provided in this type.

The price of both standard and hospital types is £2 2s per pair and of lorgnette type phones £3 3s each. A matching transformer suitable for supplying a loop from domestic radio receivers costs 12s 6d. The makers are the Magnetic Broadcasting Co., Ltd., 1, Upper Richmond Road, London, S.W.15.



Stethophone magnetic induction headphones, showing (inset) the principle of operation.

FEBRUARY MEETINGS

Institution of Electrical Engineers

London.—February 7th. Discussion on "The Problem of Radio Interference" opened by C. W. Sowton at 5.30.

February 9th. "A Study of Commercial Time Lost on Transatlantic Radio Circuits Due to Disturbed Ionospheric Conditions" by J. K. S. Jowett and G. O. Evans; and "Performance Characteristics of High-Frequency Radio Telegraph Circuits" by A. M. Humby, C. M. Minnis and R. J. Hitchcock at 5.30.

February 14th. Discussion on "Teaching Faraday's Law of Electro-Magnetic Induction" opened by P. Hammond at 6.0.

February 21st. "The Recent Search for and Salvage of the Comet Aircraft near Elba" by Cdr. C. G. Forsberg, R.N., and G. G. MacNeice at 5.30.

All the above meetings will be held at Savoy Place, W.C.2.

Cambridge Radio Group.—February 15th. "Colour Television" by L. C. Jesty at 8.15 at the Cavendish Laboratory, Cambridge.

North-Eastern Radio & Measurements Group.—February 7th. "Radio Aids to Marine Navigation" by Capt. F. J. Wylie, R.N. (Ret.), at 6.15 at King's College, Newcastle-upon-Tyne.

North-Western Radio Group.—February 16th. "An 8MeV Linear Accelerator for X-ray Therapy" by C. W. Miller at 6.45 at the Engineers' Club, Albert Square, Manchester.

South Midland Radio Group.—February 28th. "Thermionic Valves of Improved Quality for Government and Industrial Purposes" by E. G. Rowe, P. Welch and W. W. Wright at 6.0 at the James Watt Memorial Institute, Great Charles Street, Birmingham.

North Midland Centre.—February 21st. Faraday lecture "Courier to Carrier in Communications" by T. B. D. Terroni at 7.0 at the Town Hall, Leeds.

North Staffordshire Sub-Centre.—February 14th. "A Transatlantic Telephone Cable" by M. J. Kelly, Sir Gordon Radley, G. W. Gilman and R. J. Halsey at 7.0 at Duncan Hall, Stone.

South-West Scotland Sub-Centre.—February 2nd. "A Study of Some of the Properties and Materials Affecting Valve Reliability" by E. A. O'Donnell Roberts at 7.0 at the Institution of Engineers & Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2.

Western Centre.—February 8th. Faraday lecture "Courier to Carrier in Communications" by T. B. D. Terroni, at 6.30 at Brangwyn Hall, Swansea, and on February 10th at 6.45 at Colston Hall, Bristol.

British Sound Recording Association

London.—February 18th. "Electro-Acoustics of Microphones" by H. A. M. Clark at 7.0 at the Royal Society of Arts, John Adam Street, W.C.2.

Manchester Centre.—February 14th. "Reproducing Needles" by L. Rollin at 7.30 at the Engineers' Club, Albert Square, Manchester.

Radar Association

London.—February 23rd. "Airborne Electronic Equipment" by Air Vice-Marshal R. G. Hart at 7.30 in the Anatomy Theatre, University College, Gower Street, W.C.1.

British Institution of Radio Engineers

London Section.—February 23rd. "A Versatile Electronic Engine Indicator" by R. K. Vinycomb (Southern Instruments) at 6.30 at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1.

West Midlands Section.—February 9th. "Electronic Motor Control Systems" by J. C. Rankin (B.T-H.) at 7.15 at the Wolverhampton and Staffs. Technical College, Wulfruna Street, Wolverhampton.

North-Eastern Section.—February 9th. Papers by students at 6.0 at Neville Hall, Westgate Road, Newcastle-upon-Tyne.

Merseyside Section.—February 3rd. "Colour Television—Prospects and Problems in the U.K." by D. W. Heightman (English Electric) at 7.15 at the College of Technology, Byrom Street, Liverpool, 3.

North-Western Section. — February 3rd. "Recent Developments in Test Gear in the Radio, Television and Radar Fields" by A. G. Wray (Marconi Instruments) at 7.0 at the Reynolds Hall, College of Technology, Sackville Street, Manchester.

South Wales Section.—February 23rd. "The Training of Radio Engineers" by H. W. French (H.M. Inspector of Technical Colleges) at 6.30 at the Glamorgan Technical College, Treforest.

Scottish Section.—February 10th. "Radio Telephone Systems to the Islands" by T. Moxon (G.P.O.) at 7.0 at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2.

Television Society

London.—February 11th. "Television Coverage of Gt. Britain" by R. A. Rowden (B.B.C.) at 7.0 at the Cinematograph Exhibitors' Association, 164, Shaftesbury Avenue, W.C.2.

February 24th. "Modern Microwave Techniques" by R. L. Corke (P.O Research) at 7.0 at the C.E.A., 164, Shaftesbury Avenue, W.C.2.

Radio Society of Great Britain

London.—February 25th. "Radio Astronomy and the Radio Amateur" by R. C. Jennison (Jodrell Bank Experimental Station) at 6.30 at the I.E.E. Savoy Place, W.C.2.

Society of Instrument Technology

Chester Section. — February 23rd "Some Useful Electronic Circuits for Measuring Purposes" by E. Higham (Lever Bros.) at 7.0 in the Board Room of the Chester & Dist. Hospital Committee, 5, Kings Buildings, King Street, Chester.

Fawley Section.—February 4th. "Electronic Computers" by a member of the staff of Elliott Bros. at 7.0 in Copthorne House, Fawley, Hants.

Incorporated Practical Radio Engineers

East Midlands Section.—February 25th. "Transistors and Their Possible Future Uses" by a member of the staff of the G.E.C. at 7.15 at the Electricity Board Demonstration Theatre, Smithy Row, Nottingham.

Midlands Section.—February 22nd. "Cathode Ray Tubes" by a member of Mullard's staff, at 7.30 at the Connaught Room, Imperial Hotel, Temple Street, Birmingham.

SOUND *Versatility in*

The TRIX range of *quality* Sound Equipment is the most comprehensive available. There are amplifiers and accessories for all requirements—small, large, indoors or outdoors, permanent or portable. And TRIX workmanship is respected throughout the world. Our catalogue and technical advice are at your disposal.

Model RE48. A heavy duty reflex type weatherproof horn speaker with exceptional range and performance. Very suitable for all public address work

Enclosed rack type equipment **RGA4 633.** Combines 30 watt amplifier with pre-set radio, priority microphone control and 3-speed changer.

SERVICE IN SOUND BY

TRIX

The TRIX ELECTRICAL Co. Ltd.

1-5 MAPLE PLACE, TOTTENHAM CT. ROAD, LONDON, W.1. Phone: MUSeum 5817. *Telegrams and Cables: TRIXADIO, WESDO, LONDON.*

RANDOM RADIATIONS

By "DIALLIST"

Exploring Band III

HIGHLY interesting results should emerge from the Band III reception tests which those enterprising people Belling and Lee are soon to begin. As you probably know, Sutton Coldfield is radiating experimental square-wave transmissions on the 189.75 Mc/s vision carrier frequency which has been allotted to the I.T.A. for its Midland service. The Belling-Lee test unit will first of all balance up the Band I and Band III vision signals from Sutton Coldfield at some convenient spot where both are well received. It will then drive over a large part of the service area and a careful record of the comparative strengths of the two signals will be made. Myself, I believe that in districts which are not of the hill-and-valley kind the range of the Band III transmission will turn out to be a good deal greater than many people think. When Wrotham started its sound transmissions in Band II with an output of around 20kW most of us thought that it wouldn't reach out very far; but at 40 odd miles I get a tremendous signal from it with a simple dipole, provided with neither reflector nor director. I'm told, too, that it is received as far away as Shrivenham, Berks (90 miles). If Band II exceeded expectations in the matter of range, I don't see why Band III shouldn't provide surprises as well.

Shadows and "Ghosts"

But Band III is likely to present some pretty problems in hilly country, where wireless shadows may abound. The travelling test unit will have plenty of opportunities of finding out, for there are hills galore around Birmingham. I can testify to that, for I'm writing these notes right up in the Lickey Hills, where I've been staying since Christmas. They're only about 10 miles from the middle of the City. Looking out of the window, I can see the Warwickshire Hills to the south-east; and there'd be another lot in view to the south-west if it wasn't for a belt of trees. My bet, then, is that reception of the Midland Band III transmitter will be rather patchy. "Ghosts" may also be a considerable nuisance, for the shorter the wavelength, the more liable is it to reflection. On the whole, I think that the I.T.A. engineers will have some difficult siting problems; and I doubt whether they'll find the B.B.C.'s aerial masts of much use to them in some places. There'll be some hard thinking, too, for the designers of Band III receiving aerials intended for use in places where "ghosts" abound or the field strength is on the poor side.

North Hessary Tor and Others

THE B.B.C. didn't expect the low-power temporary transmitter at North Hessary Tor to be of much use to Torquay and parts adjacent. But I've already heard from two friends who live there that it is giving them an excellent signal. In the case of one of them this is a great surprise. His house is towards the Babbacombe end of the town and the ground to north and north-west of it, which lies between it and the transmitter, slopes steeply upward. So steeply, in fact, that you don't have to go far from the back of the house to be on a level with the aerial, which must be a very long way below the line of sight from North Hessary Tor. Rowridge, I.o.W., seems also to be giving a service at a greater distance than was predicted; in some directions, at any rate. There was a storm of indignation, by the way, on the Island when one of the B.B.C. announcers, when giving details of the impending opening of Rowridge, pronounced the first syllable to rhyme with "blow" instead of with "plough." Five new medium-power TV transmitters should be in full operation with their permanent aerial masts before the end of the year. These are Meldrum, Rowridge, Pontop Pike, Divis and North Hessary Tor. The whole of the B.B.C.'s No. 1 programme system should be completed within the following twelve months by the addition of the medium-power Norwich station and the five low-power transmitters planned.*

"Europe No. 1"

THOSE monstrous radio and television stations projected for the Saar and for Monaco are likely to be pretty bad nuisances. So far as this country is concerned, the Saar's 500-kW sound transmissions aren't likely to do much harm, for they are on the

* These will be at, or near, Dover, Inverness, Londonderry, Towyn, and Carlisle.

ASSOCIATED ILIFFE TECHNICAL BOOKS

"WIRELESS WORLD" PUBLICATIONS

	Net Price	By Post
RADIO LABORATORY HANDBOOK. M. G. Scroggie, B.Sc., M.I.E.E. 6th Edition	25/-	26/3
RADIO VALVE DATA. 4th Edition. Compiled by the Staff of "Wireless World"	3/6	3/10
SHORT-WAVE RADIO AND THE IONOSPHERE. T. W. Bennington, Engineering Division, B.B.C. Second Edition	10/6	10/10
SUPERHETERODYNE TELEVISION UNIT. Second Edition	2/6	2/8
INTRODUCTION TO VALVES. R. W. Hallows, M.A. (Cantab.), M.I.E.E., and H. K. Milward, B.Sc. (Lond.), A.M.I.E.E.	8/6	8/10
WIRELESS WORLD TELEVISION RECEIVER MODEL H: Complete constructional details with notes on modernizing the original design	3/6	3/9
RADIO INTERFERENCE SUPPRESSION as Applied to Radio and Television Reception. G. L. Stephens, A.M.I.E.E.	10/6	10/11
SOUND RECORDING AND REPRODUCTION. A B.B.C. Engineering Training Manual. J. W. Godfrey and S. W. Amos, B.Sc. (Hons.), A.M.I.E.E.	30/-	30/8
ADVANCED THEORY OF WAVEGUIDES. L. Lewin	30/-	30/7
FOUNDATIONS OF WIRELESS. M. G. Scroggie, B.Sc., M.I.E.E. 5th Edition	12/6	13/-
TELEVISION RECEIVING EQUIPMENT. W. T. Cocking, M.I.E.E. 3rd Edition	18/-	18/8

A complete list of books is available on application.

Obtainable from all leading booksellers or from

ILIFFE & SONS LTD. Dorset House, Stamford Street, London, S.E.1.

long waves and probably won't interfere with Droitwich. But the TV transmissions may cause havoc, particularly when sporadic E is much in evidence. Interference with television reception here was widespread last year at intervals from early June until December. It's a thousand pities that European countries can't get together over the very important question of sound and vision broadcasting channel allocation.* If only we could agree to arm an international body with the powers of the United States Federal Communications Commission!

"*Potmeters*"

IT'S a queer thing that after all these years we still seem to find it so difficult to make reliable and long-lived controls of the potentiometer type. I'm thinking particularly of those used as volume controls and for the contrast control in TV receivers. Far, far too soon do many volume controls become scratchy and scrapy; far, far too soon do those used for the contrast develop such jumps and jerks that it becomes difficult to adjust the gain exactly to your liking. There are, I know, types which don't behave in this exasperating way; and that makes it all the more puzzling that set manufacturers should be content to use any other sort.

Overheating

SUFFICIENT attention isn't always paid by designers to the cooling arrangements in broadcast receivers. Yes, I know that when a set starts dripping blobs of waxy stuff on to the table beneath it the cause may often be that its owner has so placed it that its back is jammed tight against the wall. But it isn't always so. I've seen nasty messes made by sets which were standing well away from the wall. And once that sort of thing starts trouble is on the way. Sometimes the ventilating louvres are in the wrong place; sometimes there aren't enough of them; sometimes they're not long enough. They can't be made wider because they must not allow a "standard finger" to be poked in far enough to touch any live part. Adequate cooling is probably made more difficult by the use of miniature valves; for these run very hot and owing to the smallness of their bulbs there is only a restricted area from which heat can be dissipated.

* Monaco was a signatory to the Stockholm v.h.f. plan under which she is allocated a 50-kW (e.r.p.) television station in each of Bands I and III. The Saar was allocated a 100-kW (e.r.p.) station in Band I.—Ed.

GLASS-ENCLOSED CARTRIDGE
FUSES
ALL SIZES AND TYPES FOR MANY USES

All Bulgin Cartridge Fuses are Safe, Certain, and Fireproof. They constitute reliable safeguards against damage to apparatus by overload and are simple and inexpensive to replace. They are uniform and accurate, with highly-silver-plated contact caps. Many sizes and types including models for Automobile and Aircraft use.

ELECTRONICALLY SEALED

Conforming with the latest trends in the manufacture of glass-enclosed cartridge fuses, Bulgin now electronically seal all standard 1¼in. fuses. This method of construction gives a stronger and more reliable fuse and ensures that the end caps will not work loose or pull off without fracturing the glass.
The silvered end-caps now present a cleaner exterior surface free from all solder. The fuse element is absolutely protected from ingress of moisture or other injurious matter.

AVOID UNNECESSARY REPLACEMENTS BY FITTING "PAK" FUSES

List No.	Carrying
PAK.1	250 mA.
PAK.2	500 mA.
PAK.3	750 mA.
PAK.4	1.0 A.
PAK.5	1.5 A.
PAK.6	2.0 A.

WHERE surges take place as in the primaries of Mains Transformers, etc., fuses may blow unnecessarily. "**PAK**" types are normally delaying and withstand about 75 per cent. overload for approx. 120 secs. Upon the application of 200 per cent. rating, or more, blowing is instantaneous.

BULGIN
THE CHOICE OF CRITICS

A. F. BULGIN & CO. LTD., BARKING, ESSEX
MANUFACTURERS OF RADIO AND ELECTRONIC COMPONENTS
Telephone: RIPpleway 3474 (5 lines)

UNBIASED

By FREE GRID

Cuckoo in the Nest

I WAS deeply interested in the Editor's plea in the December and January issues that the control of wireless should be taken out of the hands of the P.M.G. and his all-powerful department. But while desiring to strike the G.P.O. gyves from the wrists of radio he is obviously unable to shake the shackles of editorial caution from himself. In this matter he shows something of a Menshevik mentality rather than the ruthless spirit of the "Old Bolsheviks" which has always characterized his utterances on other matters.

This is clearly shown by the pious hope expressed in the January issue that the Minister who replaces the P.M.G. in assuming parliamentary responsibility for radio will *not* be one who is the head of any of those ministries which are large and greedy users of radio channels. This, surely, is the original argument put forward years ago by the Editor emeritus of *W.W.* against the P.M.G.'s stewardship. Although that argument still stands, it forms only one count in the case against G.P.O. control.

Radio has grown up since the P.M.G. took it over as a puling infant in 1904, and is more than big enough to justify having a ministry of its own to control its multifarious interests. It is, in fact, fast becoming a cuckoo in the nest, as its rate of growth is so prodigious that in a few years it has already crowded out the G.P.O.'s more legitimate interests, and if handed over to another ministry it would eventually do this cuckoo act in its new nest. Distasteful as the idea may sound to many, what we seem to need is a Ministry of Radio.

Racing by Radio

THERE does not at first sight appear to be much connection between racing and radio, but if certain suspicions of mine are confirmed there will prove to be a very strong connection indeed. As we all know, there are sometimes unexpected results in racing, horses which were considered "dead certs" by the experts being outstripped easily by rank outsiders.

It has been suggested that some of these unexpected results could be accounted for by jockeys receiving pre-race instructions from unscrupulous owners and trainers not to try too hard. The racing correspondent of one national daily writing about this matter at the end of the last "flat" season rather pooh-poohed the idea. He considered that pre-race instructions were greatly over-rated, but added that if it were possible for an unscrupulous interested party to communicate with a jockey during the progress of the race it would then be a matter for serious concern. When reading this my worst suspicions were aroused, for during the past season there seems—judging by the money I have lost—to have been an exceptionally large number of these "unexpected results."

It would be a perfectly easy matter to design an ultra-compact lightweight receiver which could be carried about a jockey's person; in fact the thing needn't be concealed, for it could be disguised as a hearing

The bowed shape of his legs gave him away.

aid. I find there is nothing in the rules of racing against a jockey wearing an aid to hearing any more than there is against his wearing an aid to clear speech in the form of a well-fitting denture.

At this time of the year jockeys are in normal civilized garb but there is no mistaking one as his small stature and the bowed shape of his legs give him away. Whenever I pass such a figure, as I did the other evening outside a famous club in the Pall Mall, I cannot help regarding him with suspicion although I must confess that so far I have yet to find one wearing a hearing aid.

Euroscopes

EIGHTEEN YEARS ago when the B.B.C. was giving us M & B transmissions from Alexandra Palace on alternate days, television receivers were provided with a switch to change over from the M to the B system and *vice-versa*. As in the case of the famous tablets each of the letters M and B is the initial of a well-known man, and they are used instead of their names, to prevent identification which would result in a free advertisement to their respective firms.

Now, this change-over switch meant quite a lot of complication in the receiver for, not only was the lineage different in the two systems but one used interlacing and the other didn't. But all these problems were solved. I feel, therefore, that it should not be too difficult for some enterprising manufacturer to solve similar problems and produce a set having a change-over switch labelled "British" and "French." This would enable those living in the Cinque Ports section of the south coast to receive French programmes when desired.

I put forward this suggestion as I have a friend living on the White Cliffs of Dover who has a French television set and gets better reception from Lille than he does from A.P. on his British set. He has also been getting a goodly number of viewers to see the French programmes at his house with the result that several French sets have been imported, some by people who do not speak French. Surely this shows that some of the French programmes have a greater eye appeal than anything the B.B.C. radiates. It would seem, therefore, that there might be a market for change-over sets in suitable high-ground localities on the south coast and even a bit inland. The Channel Islands might be another suitable locality for these Anglo-Euroscope receivers.

Tape Recorders

I WAS very interested in a letter published in the December issue in which various shortcomings of tape recorders were pointed out and suggestions made whereby manufacturers could improve them. There was one particular complaint with which I heartily agree and that is the irritating business of loading and threading up. No mention was made, however, of what is, in my opinion, the ideal way of getting rid of this bugbear and that is to follow the technique that has found so much favour with the users of amateur cine cameras.

At one time it was quite a work of art to load an amateur cine camera *quickly* without getting the film all snarled up. Minor improvements were made but the real thing which put joy into the business was the development of cassette loading. It is the work of a moment to slip into the camera specially designed for it a cassette consisting of a tin box containing both spools, with the film all threaded up ready for use.

It would be necessary to redesign the deck of the tape recorder. But eventually the old separate spool recorders would die a natural death.

Sales up 300%!

with the NEW

LEAK

TL/10 AMPLIFIER &

"POINT-ONE"

PRE-AMPLIFIER

27 GNS COMPLETE

A price made possible only by WORLD-WIDE SALES

★ *Make this THE HEART of your HI-FI EQUIPMENT*

and this is why

From long experience and by extreme attention to design details during development work on the pre-production models, we enable our labour force to achieve a high output per man-hour. The labour costs thus saved offset the increased costs incurred for high-grade materials, components and finishes, and this together with quantity production (made possible only by a world-wide market) explains how quality products may be sold at *reasonable prices*. The results obtainable with the new Leak TL/10 and "Point One" are indistinguishable from those obtained with the TL/12 model — a fact easily proved by an instantaneous changeover test. The new TL/10 has been used since its introduction for *all* our public demonstrations, including those at the New York Audio Fair. These are some of the reasons why sales of the TL/10 and "Point One," since their introduction in April last year, are three times as great as for the famous TL/12 in the corresponding months of 1953—and why the size of our factory has been more than doubled to cope with this increased demand.

TL/10 POWER AMPLIFIER

This 10 watt amplifier maintains, in every respect, the world renowned Leak reputation for precision engineering, fine appearance and fastidious wiring.

SPECIFICATION

Circuitry

A triple loop feedback circuit based on the famous TL/12. The output transformer is the same size as in the TL/12.

Maximum power output: 10 watts.

Frequency Response: ± 1 db 20 c/s to 20,000 c/s.

Harmonic Distortion: 0.1%, 1,000 c/s. 7.5 watts output.

Feedback Magnitude: 26 db, main loop.

Damping Factor: 25.

Hum: — 80 db referred to 10 watts.

Loudspeaker Impedances: 16 ohms, 8 ohms, and 4 ohms.

"POINT ONE" PRE-AMPLIFIER

The handsome gold escutcheon plate contributes to the elegant appearance, and blends with all woods.

★ **Pickup**
The pre-amplifier will operate from any pickup generally available in the world. A continuously variable input attenuator at the rear of the pre-amplifier permits the instantaneous use of crystal, moving-iron and moving-coil pickups.

★ **Radio**
The radio input sockets at the rear permit the connection of the LEAK V.S. tuner unit. An input attenuator is fitted. H.T. and filament supplies are available from the pre-amplifier.

★ **Distortion**
Of the order of 0.1%.

★ **Hum**
Negligible, due to the use of recently developed valves and special techniques.

★ **Input selector**
Radio, tape, records; any and all records can be accurately equalised.

★ **Treble**
Continuously variable, + 9 db to — 15 db at 10,000 c/s.

★ **Bass**
Continuously variable, + 12 db to —13 db at 40 c/s.

★ **Volume Control and Switch**
The switch controls the power supply to the TL/10 power amplifier.

★ **Tape Recording Jacks**
An exclusive feature. Readily accessible jacks are provided on the front panel for instantaneous use with Tape Recorders which have built-in (low level) amplifiers.

★ *Write for leaflet W* ★

H. J. LEAK & CO. LTD., BRUNEL ROAD, WESTWAY FACTORY ESTATE, ACTON, W.3

'Phone: SHEpherds Bush 1173/4/5 *Telegrams: Sinusoidal, Ealux, London* *Cables: Sinusoidal, London*

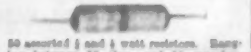
CHASSIS ASSEMBLY

3 colour, 3 waveband scale covering standard, Long, Medium, and Short wavebands, scale pan, chassis punched for standard 5-valve superhet, pulley driving head, springs, etc., to suit. Scale size 14½in. × 3½in. Chassis size 15in. × 5in. × 2in. deep. Price 15/-, plus 1/6 post Note.—This is the one that fits our 39/6 table cabinet.

RADIO SCALES, 4/- DOZEN

An exceptional bargain this month is our assorted parcel of radio scales. A most useful collection for all who make up experimental or other radios. We offer twelve assorted scales mostly in two or three colours for 4/-, plus 9d. post and packing. Limited quantity only.

RESISTORS



50 assorted ½ and ¼ watt resistors. Ranging between 10 ohm. and 10 megohm. (Our selection.) Price 5/- pkt. Ditto, 1 watt, 7/6.

EX-ROYAL NAVY SOUND POWERED TELEPHONE

These require no batteries, and will go for long periods without attention. Complete with generator and sounder which gives a high pitched note, easily heard above any other noise. Also fitted with an indicator lamp which in quiet situations can be used instead of the sounder, or where several are used together will indicate which one is being called. Size 7½in. × 9in. × 7½in., wall mounting, designed for ships' use, but very suitable for home, office, warehouse, factory, garage, etc. Price 57/6 each, plus 4/6 carriage.

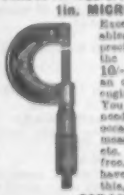
INSTANT HEAT CONVECTOR

The heater with the lowest possible thermal capacity, 4ft. long; made from heavy gauge sheet steel (galvanised), 1 kW., suitable A.C. or D.C. Price only £2, or with thermostat £3/15/-. Note.—The thermostat mounts separately and will control up to three heaters.

CLEVELAND CAR BATTERY CHARGER

Gives 1¼ amp. charge—uses everlasting metal rectifier and robust double wound mains transformer in metal carrying case with leads and croc. clips. Price, 6 volt, 29/6; 6 and 12 volts, 39/6, post 2/6.

1in. MICROMETER



Exceptional purchase enables us to offer a 1in. precision micrometer at the very low price of 10/-. A micrometer is an essential part of an engineer's equipment. You will have found the need for one on many occasions in the past for measuring wire gauge, etc. Price 10/-, post free. Note.—We now have a waiting list for this, orders in rotation.

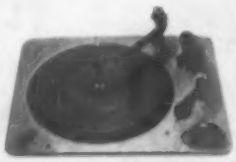
OSRAM 912

The constructional data for this Hi-Fi amplifier is available, price 3/6, which amount will be credited to you if you buy the components later. One "912 Shopping List" will be included with the booklet.

GENUINE HALF-PRICE OFFER

BEETHOVEN CHASSIS

Extremely well built on chassis size approx. 9½ × 7½ × 8½, using only first-class components, fully aligned and tested, 110-240-volt A.C. mains operation. Three wave bands covering medium and two shorts. Complete with five valves, frequency changer, double diode triode, pentode output and full wave rectifier. Special cash-with-order price this month, £5/19/6, carriage and insurance 7/6.



GRAMOPHONE AUTO-CHANGER

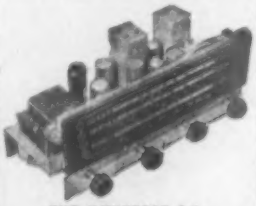
Latest type by all famous makers are invariably in stock at competitive prices.

BARGAIN FOR CONSTRUCTORS

Modern style cabinet in contrasting veneers, with metal chassis, three knobs, coloured escle, and pointer. Price 29/6, post, etc., 2/-. All other components to build 2-waveband superhet. Price £5. Data, 1/6 (free with components.)

COILS—T.R.F. AND SUPERHET

T.R.F. long and medium wave with circuit diagram, 5/6. Superhet long, medium, and short wave, aerial and oscillator coils, e.g., set of six coils with circuit, 10/6.



THE "WINDSOR 6"

This is a 6-valve A.C. superhet covering the usual long, medium and short wavebands. It has a particularly fine clear dial with an extra long pointer travel. The latest type octal valves are used and the chassis is complete and ready to operate. Chassis size 15in. × 6in. × 6in. Price £9/19/6 complete with 8in. speaker. Carriage and insurance 10/-. H.P. terms if required.

TABLE RADIO CABINET

Due to a special purchase, we are able to offer this very fine cabinet, size approx. 15½ × 14 × 6½in. Walnut veneered and satin finished, 39/6, carriage and packing 3/6. Note.—This cabinet is the correct size for the Windsor chassis above with 6½in. speaker.

HEATING TRANSFORMER

2½ volts at 400 amps. Continuous rating; suitable for unfreezing water pipes; setting of resins during casting, setting of glues during cabinet making, edge veneering, etc., etc. Complete in metal case with carrying handle, price £12, carriage and packing 5/-.

LIGHTWEIGHT REFLECTORS

Ideally suitable for all purposes where the intensification of electric illumination or Infra Red is required. The material used is lightweight aluminium, highly polished. All are pierced for Standard Lampholders.

STAR. 7½in. dia. by 6in. deep. Price 7/6 each. Post, etc., 1/3.

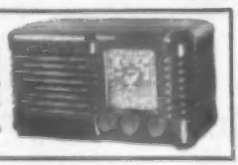
SENIOR. 11½in. dia. by 4in. deep. Price 13/6 each. Post, etc., 1/9.

JUNIOR. 6½in. dia. by 2½in. deep. Price 7/3 each. Post, etc., 1/3.

BIJOU. 5½in. dia. by 2in. deep. For 40-60 watt lamps. Price 6/6 each. Post, etc., 1/3.

BELL. 8½in. dia. 5in. deep. Price 6/3 each. Post, etc., 1/3.

TERRIFIC NEW CIRCUIT



OCCASIONAL 5S.—we have evolved a new T.R.F. circuit and have had really amazing results, equal in fact to many superhets. You really should try this circuit. All parts including valves (6K7, 6J7, 6Q7G, and 6X5) and Bakelite case with back cost only £5/10/-, plus 2/6 post and insurance. Data included with the parts is also available separately price 2/-.

TRANSFORMER 100 WATTS

These are transformers with a wound primary tapped 200, 220, 240, but no secondary. There is ample window space, however, for the hand winding of secondary to suit your own requirements. Approximately two turns per volt are required. The amps. taken out will depend upon volts, e.g., 10 amps. at 10 volts, 50 amps. at 2 volts, etc., etc. Price 10/-, post and packing 2/-.

DECCA CRYSTAL PICK-UP

A snip for the connoisseur—turnover head suitable all records—limited quantity 39/6, plus 2/- post and packing.

G.E.C. METAL CONE SPEAKER

This fine speaker is coming to the front rapidly—price £2/18/-. Octagonal cabinet made to maker's specification, £11/10/-, walnut or oak.

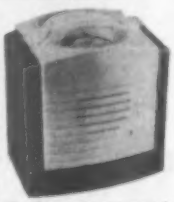
HIRE PURCHASE TERMS.—Any goods costing £5 or more may be purchased by extended payments—deposit 10% (or more)—balance spread over 12 months.

BARGAINS TO CLEAR

2-VOLT ACCUMULATORS

Made for the Forces by one of the most famous firms in the world. 15 amp.-hour, size approx. 6 × 1¼in. square in ebonite case, pre-charged, only need filling with acid, 2/9 each, plus 1/- post and insurance.

PORTABLE CABINET



This is ultra-modern, two-tone, bakelite with integral moulded handle. We can supply, where required, the metal chassis, dial, and all other parts necessary to make a Mains or Battery portable. Note: All of these cabinets have slight imperfections; these are hardly noticeable however, and will not impair the performance or safety of the set. Price 7/6 each, post and insurance 3/6.

REMOTE CONTROL

With only one pair of wires and a simple push button you can select any one of four stations. This is just one of the many applications of our impulse relay. There are many other purposes to which it can be put. Note they are somewhat soiled, due to storage, but mechanically O.K. Price 1/9, post 6d.

5-AMP. SURFACE SWITCHES—HIGRAFT

Oblong Brown 1-way 1/- each. Oblong White 1-way 1/- each. Oblong Brown 2-way 1/3 each. Oblong White 2-way 1/3 each. Round Brown 1-way 10d. each. Round White 1-way 10d. each. Round Brown 2-way 1/- each. Round White 2-way 1/- each.

WAVE-CHANGE SWITCHES

One dozen assorted wave-change switches, ideal for experimenters. Note, these are unused and not removed from equipment. Our assortment. Price 5/-, post and packing 1/-.

110-VOLT 2½-AMP. RECTIFIER UNIT

This is an excellent unit suitable for driving 110 v. D.C. equipment from 230 v. A.C. mains or for charging batteries for stand-by lighting, etc. Made for the Government—new and unused, with switchgear. Price £17/10/- each.

NAIL INSULATORS

Suitable for electric fences, indoor aerials, etc., 3/- per dozen, post and packing 1/-.

WESTINGHOUSE RECTIFIER

Full wave—suitable for up to 20 volts at 15 milliamps. Ideal for relays, meters, etc. Price 2/6, post 6d.

SPADE TERMINALS

Heavy duty type made for M.O.S. Price 7d. each, 6/- per dozen.

SEE OVER →

MAKE A CONVECTOR

Almost any metal case can be converted into a useful convector type electric heater if you use our porcelain mounted element 2500 watts small size. Price 2/6, post 6d.

CAR STARTER/CHARGER KIT

All parts to build 6- and 12-volt charger which can be connected to a "flat" battery and will enable the car to be started instantly. Kit comprising the following:—

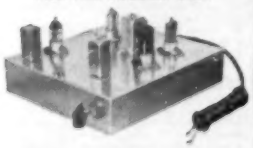
Mains transformer	19/6
6-amp. rectifier	10/6
Regulator Stud Switch	3/6
Resistance Wire	2/-
Resistance Former	2/6
Mains on/off Switch	1/-
0-5-amp. Moving Coil Meter	9/6
Constructional Data	1/6

or if bought all together price is 59/6, plus 2/- post and packing.

THE TWIN 20

This is a complete fluorescent lighting fitting. It has built-in ballast and starters—stove enamelled white and ready to work. It is an ideal unit for the kitchen, over the work-bench, and in similar locations. It uses two 20-watt lamps. Price, complete less tubes, 29/6, or with two tubes, 39/6. Post and insurance, 2/6. Extra 20-watt tubes 7/6 each.

THE F.M. FEEDER UNIT



All the parts necessary to make the Denco F.M. Unit are now available. The unit given an A.F. output suitable for feeding in at the pickup sockets of any standard broadcasting receiver and superior results can be expected. The full constructional details as prepared by the Denco technicians are available—price 1/6 post free. Alternatively, they will be given free to those ordering all the parts which come to £8/7/6, plus 2/6 post and packing. Note: Four valves and everything including a prepared metal chassis is supplied. Approximate chassis measurements are 6 × 6 × 1½. Demonstrations at our branches.

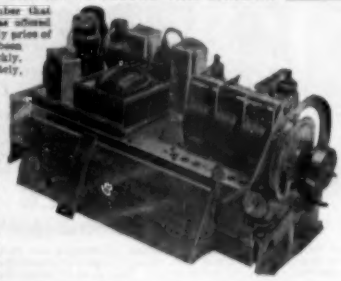
ALL MAINS THREE

A handy midget A.C./D.C. 3-valve mains receiver giving powerful reception over long and medium waves. All component parts, including valves, coils, resistors, etc., but not loudspeaker and cabinet (you may already have these) will cost you only 19/6 plus 1/6 post.—data available separately 2/- post free.

PLUGS FOR MODERN VALVE HOLDERS

Each is fitted with a rubber shroud. For B7G button base and type 2 for B8A. Price 1/4 each, discounts for quantities.

LAST CHANCE TO SECURE THIS BARGAIN



Readers will remember that this fine receiver was offered last month at the silly price of £5 and they have been going out very quickly. If you send immediately, however, you will probably be just in time to secure one. The set, a product of one of our famous manufacturers, has H.F. stage, tuning indicator, and all modern refinements, covers 5 wavebands including short wave to 11 metres. Offered less valves and power-pack, otherwise complete and unused—price £5, carriage 7/6 (uses octal range valves).

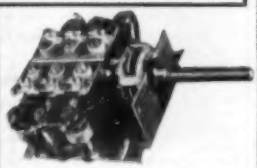
COMPLETE TOOL KITS—

THE ELECTRICIAN'S

This is as illustrated and contains 35 fine tools arranged on 5 trays in an automatic steel tool-box. The box opens under slight pressure of the hand and closes automatically when lifted. The tools are all that a practical electrician needs, including tenon saw, ratchet brace, hack-saw, chisels for wood, brick and steel, pliers, side cutters, hammers, spanners, socket wrenches, pad-saw, etc. Price £15/10/-, or H.P. if required.

RADIO ENGINEER'S

This again is fitted into an automatic tool-box and contains 50 tools including pliers, side cutters, screwdrivers, side and straight snips, hacksaws, spanners, and socket wrenches, hand-drill, B.A. taps, drills, etc. Price £11/10/-. H.P. terms if required.



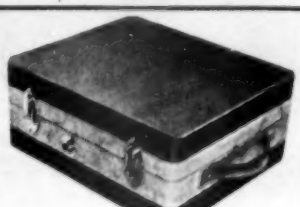
COIL PACK 19/6

Manufactured by quite a famous company, this 2-wave Coil Pack incorporates a gram position and Long, Medium and Short wave band, designed for 465 kc/s. I.F. Brand new and fully guaranteed. Complete with circuit, only 19/6 plus 9d. post.

KNOBS

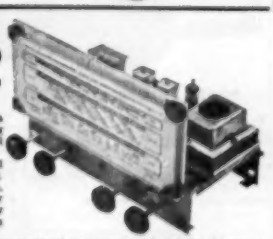
Set of four brown knobs ¼in. dia. Engraved tone, volume, tuning wave band. Push-on type. Post 6d. Ref. 2346. Price per set 1/3.

THIS MONTH'S SNIP



ATTACHE CASE. Complete with leather handle and clasps—suitable for almost any portable instrument. Limited quantity—price 23/6 carriage and packing 2/6. A similar model but slightly smaller and in case colour 19/6, plus 2/6 carriage.

THE CLEVELAND "ORGANTONE"



The Cleveland "ORGANTONE" is a 5-valve 3-wave band superhet covering long, medium and short wave. Built to a very stringent specification. Ouram miniature valves are employed and low loss iron cored coils account for an excellent signal to noise ratio. Full A.V.C. is applied to both frequency changer and I.F. stages, and particular care has been taken to ensure freedom from frequency drift.

The output stage utilises variable negative feedback for tone control, and, but for standard pentode correction, no cut in the ordinary sense is applied. A gram. position is provided and reproduction of records is particularly good. An amply proportioned power transformer with a primary tapped for 110-250 volts gives complete isolation from the mains.

Chassis size is 12in. × 7in. × 7in.—Scale size is 10½in. × 4½in.

This receiver has been tested in particularly difficult areas and its stability and noise rejection have produced exceptional results.

Price £11/10/- or £1/5/0 deposit—carriage, etc., 7/6.

A circuit diagram and photograph available price 2/- post free.

ANOTHER CLEVELAND CHASSIS—THE "TREMENDO"

The first Cleveland chassis was good, but this one is really superb. It has a 7-valve circuit with 6 watts output, fitted with independent bass and treble controls. It is really an efficient H.F. circuit coupled to a high-fidelity amplifier. The chassis size is the same as the Organtone, namely 12 × 7 × 7 with the 10½ × 4½ multi-coloured scale, and it is built to the same exacting specification as the Organtone. Price £14/10/-, carriage and packing, 7/6. H.P. terms if required.

SOMWEAVE

This really lovely loudspeaker fabric we offer at approximately a third of to-day's cost. It is 42in. wide and our price is 12/- per yard, or panels 12in. × 12in., 1/9 each. This is also very suitable for covering plain wooden cases, for portable radio amplifiers, etc.

CONNECTING WIRE SNIP

P.V.C. insulated 23 s.w.g. copper wire in 100ft. coils, 2/9 each. Various colours available: 4 coils assorted colours for 10/-.

H.T. RECTIFIERS FAMOUS SELENIUM "SENTERCEL"

All are this year's stock—for higher voltages joint two or more in series

S.M.1	125 v.	60 mA.	2/9
S.M.2	125 v.	100 mA.	4/2
S.M.3	125 v.	120 mA.	5/9
S.M.4	250 v.	250 mA.	16/-

FLUORESCENT LIGHTING

Complete kit comprises 40-watt control unit, starter lamp, lamp holders, clips and wiring diagrams. Price, less tube, 22/6, plus 1/6 post. With tube, 30/-, plus 2/6 carr.

EVERLASTING GRAMOPHONE NEEDLES

Jewel (Sapphire) pointed, suit any type of pick-up, precision made — improves quality, eliminates record wear, 3 types, loud, soft, trailer. 2/6 each.

AMPLIFIER A1134a

This is a 2-stage intercom. and Tx pre-amplifier with transformers, etc. Easily modified as gram amplifier or dictaphone, etc. Complete with 2 S-P. valves, QPP and Triode. Price only 9/6, plus 1/6 post and packing. Circuit diagram, free with unit, or separately, 1/6.

BUREAU CABINET

This is a really beautiful cabinet elegantly veneered in walnut and finely polished. The central board, revealed when the front is dropped down to ample (or the larger than average radio chassis or amplifier and alongside there is a space for a tape recorder or auto record changer mechanism. Both the radio board and the control board are left uncut to suit your own equipment.

Size approximately 30in. high, 22in. wide, and 16in. deep. Price 16 guineas, carriage 12/6.

E.P.E. LTD. SEE OVER →

ADDITIONAL STOCK ITEMS

POTTED TRANSFORMERS

These are of really superior construction fitted in cast metal cases and compound filled. Terminals come to shoulder tagboard. All are upright mounting and have 200/230 normal 50 cycle mains input and fully screened primary.

Type 5P1. 265-0-265 at 300 m.a.; 6.3 v. at 7 amp.; 4.4 v. at 2.5 amp.; Price **35**/- plus 3/6 carriage.

Type 5P2. 365-0-365 at 150 m.a.; 4 v. at 2.5 a.; 6.3 v. at 4.2 a. Price **32/6**, carriage and packing 3/6.

Type 5P3. 1540 v. 2 v. at 2 a.; 4 v. at 1 a.; This is an ideal transformer for televisors and scopes using V.C.R. 97, etc. Price **25**/- carriage 2/6.

POTTED CHOKES

These chokes are in similar type cases and therefore match the above transformers.

Type 5P4. 5 H. at 300 m.a. Price **10**/-, carriage and packing 2/6.

Type 5P5. 10 H. at 150 m.a. Price **12/6**, post and packing 2/6.

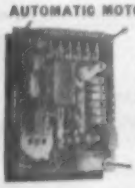
HIGH POWER TRANSFORMERS

For R.F. Heaters, transmitters, etc., etc. These are open wound type for maximum cooling and have the normal 200-250 primary fully screened.

Type 5P6. 1,000 v. at ½ amp., e.g. 15 K.V.A. Price **£8/10**/-, carriage and packing 5/-.

Type 5P7. 1,500 v. at 1 amp. e.g., 1.5 K.V.A. Price **£15**, carriage and packing 7/6.

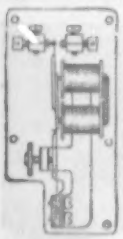
AUTOMATIC MOTOR STARTER



For remote control of D.C. motor between 1 and 3 Kw., adjustment for 100 v. or 230 v. Unused and in first-class condition, complete with metal and wired glass cover. Price **£10**, carriage 5/-.

"SNIPERSCOPE"

Famous wartime "cats eye" used for seeing in the dark. This is an infra-red image converter cell with a silver caesium screen which lights up (like a cathode ray tube) when the electrons released by the infra-red strike it. It follows that as light from an ordinary lamp is rich in infra-red these cells will work: burglar alarms, counting circuits, smoke detectors and the hundred and one other devices as will the simpler type of photo cell. Here then is a golden opportunity for some interesting experiments, price 5/- each. Data will be supplied with cells if requested.



RELAYS

Extra light weight, extra sensitive for high speed or radio control work, weight only 1½ oz., closes on 2 mA., solid platinum change-over contacts, adjustable pressures. Price **12/6**.

TELEPHONE JACK PLUGS

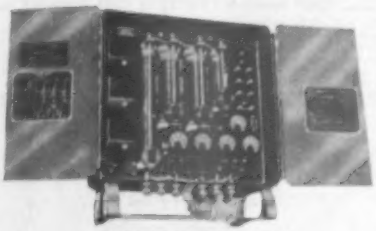
As illustrated **7d.** each. Sockets to suit, **10d.** each.

TRANSMITTER VALVE 10G T.H.

Unused and fully guaranteed. **£4/10**/- each, post and insurance 2/6.

HEADPHONES

American ear insert type (Hi-Sir), **2/6**. British moving coil type, **5/6**; High resistance, diaphragm type, **10**/-.



CHARGING SWITCHBOARD

Feed this switchboard through a Mains Transformer and Rectifier giving 24 volt D.C. up to 50 amps. and you have an excellent multi-circuit charger for simultaneously charging several batteries at different currents. This is an ex. Government switchboard rated at 550 watts 18 volts fitted into steel cases with doors. It contains three reverse current relays, one voltmeter, one main ammeter, two secondary ammeters and three variable resistors for controlling circuits. These are brand new, in original cases. Price **£4.10**/-, carriage 10/-.

We can supply a 12 volt, 50 amp Mains Transformer at **£4.5**/-, plus 5/- carriage.

AMERICAN RADAR

We have brand new, still in original unopened packing cases as shipped from America, three items of equipment which form the major parts of the radar system RC-184.

Item 1 known as Tower TR24a is in fact the aerial base and motor driven gear box which rotates the antenna.

Item 2 known as the Indicator 1-221-A incorporates a magslip device and appears not only to control the Tower but also to follow it.

Item 3 is known as Control Unit BC-1268-A, incorporates a cathode ray tube as well as a control equipment.

We shall be glad to negotiate with intended purchasers of this equipment and would also like to hear from any reader able to give any more information about it.

YOURS FOR £1 ONLY

COMMUNICATION RECEIVER R1155.

This set, as most will know, is considered to be one of the finest communications receivers available to-day. The frequency range is 75 kc/s to 18 Mc/s. It is complete with 10 valves and is fitted in a black metal case. Made for the R.A.F., so obviously a robust receiver which will give years of service. Slightly used but completely overhauled and guaranteed in perfect working order. PRICE **£7/19/6** or will be sent against a deposit of **£1**. If you cannot call to collect please include an additional 10/- to cover cost of transit and carriage. This partly returnable to you if and when you return the transit case.

MAINS POWER PACK FOR R.1155

With Pentode output stage. Plugs into socket on receiver so no internal modification are required. Price **£5/10**/- complete with 5in. speaker ready to work, carriage 3/6. If bought with receiver deposit is **20**/-.

MAGNETRONS

Precision made for RADAR type Nos. CV.186 and CV.64. Unused, guaranteed. Any not functioning correctly will be replaced. Price **£2.10**/-. Post and insurance 10/-.

POWER FOR TR1154/55

We can offer brand-new, and unused, the two rectifier units for mains operating the transmitter TR1154 and its associated receiver R1155. Both rectifier units are completely enclosed in metal cases and operate directly from normal 50 cycle A.C. mains. Price **£17/10**/- the pair, carriage and packing 15/- extra.

TRANSMITTER 1131

This is a high powered transmitter for operating over the same frequency range as the Receiver 1132, i.e., 70-130 megacycles. It is a very bulky transmitter and probably contains around £300 worth of equipment. As far as we know these have never been used but of course have been in store for a long time and therefore they will need attention before being put into operation. We offer these less valves **£37/10**/-. Buyer collects. We also have a quantity already stripped so if you are needing spares for this transmitter please get in touch with us now.

R1133

We have a small quantity of these receivers less valves still available. Their condition unfortunately is not good but they appear to be repairable, and, of course, contain a multitude of spare parts. At **30**/- each they represent a real bargain. If not collecting, please include 5/- for packing and carriage.

RECEIVER TRANSMITTER 38

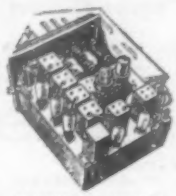
This is the British equivalent of the walkie-talkie. It operates on the frequency range 7.4-9 mc/s. It has many novelty applications in the home and can eventually be turned into a useful little portable receiver. Complete and with valves unused but not guaranteed, price **27/6**, post 2/6 extra.

STABILAVOLT

This is a valve designed and constructed to facilitate the taking off of several voltages, each of which will be stabilised These are brand new and unused. Price **10/6** each, post 1/- extra.

IMPORTANT NOTE

Owing to the bulkiness of many of the items listed on this page it may not be possible to keep stocks at all branches, therefore please telephone confirmation that the item is actually at the branch before journeying specially to see it.



10-VALVE 1¼-METRE SUPERHET

Ideal for Commercial T.V. These contain 6 valves type 6P61, and one each RL7, 2L16, and EA50. 9in IF transformers 17 Mc/s. band, and hundreds of other useful components. Price **29/6**, plus carriage and packing 7/6. These receivers are unused.

BLOCK CONDENSERS

New and unused. .5 mfd. at 2,500 v., **3/6**; 4 mfd. at 750 v., **3/6**; 8 mfd. at 500/600 v. **5**/-.

BREAKDOWN PARCEL

Unit for breaking down—offered at only a little over the price of the Aladdin Coil Formers it contains. Note. All parts can easily be removed as they are all bolted together. The unit contains:—

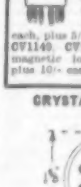
6 Aladdin 4in. Coil Formers with dust cores.
6 metal cans for above coil formers.
1 4-position 12-pole switch.
6 miniature R.F. chokes.
2 25-mfd. 25-v. electrolytics.
50 paper tubular condensers. .002 to .1 mostly for 450 v.
56 carbon resistors, values from ½ watt to 2 watt.
2 medium-size R.F. chokes.
7 moulded octal valve-holders.
1 moulded diode valve-holder.
20 mica condensers (moulded, silver and ceramic).
7 insulated top caps for valves.
4 components strips (one 40-way, one 11-way, one 5-way, and one 3-way).
1 very useful metal chassis, size 18 × 5 × 3½in.

Plus dozens of nuts, bolts, screws, washers, and other useful items such as 4in. spindle extenders, etc.

Price only **7/6**, post and packing 2/6.

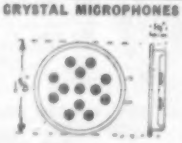
GREATLY REDUCED CATHODE RAY TUBES

VCR97. Brand new and unused, "cut off type," ideal for "scope, etc. Full picture type forty, **39/6**. Price **12/6**. Carriage and insurance 5/- extra.



VCR517. 6½in. guaranteed full picture, **29/6**, plus 5/- carriage and insurance.
VCR139A. 2½in., **22/6**, plus 2/6 carriage, etc.
VCR138. 3½in. electrostatic short persistence, suitable for T.V. and ideal for 'scope work, **37/6** plus 3/6 carriage, etc.
VCR118. 5in. electrostatic, persistence not known, **15**/- each, plus 5/- carriage, etc.
CV996. 6in. electrostatic, persistence not known, **15**/- each, plus 5/- carriage, etc.
CV1140, CV1593, CV1546. All 12in. magnetic long persistence, **£4/10**/-, plus 10/- carriage.

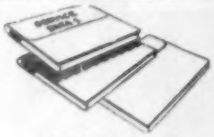
CRYSTAL MICROPHONES



Diaphragm driven, extremely sensitive, highly suitable for recorder work, No matching needed. **5/6** each.

VACUUM PUMP

Type B3 new in makers cartons—many applications in home or factory—**22/6** post 1/-.



SERVICE DATA

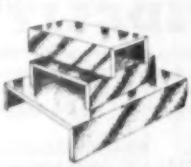
100 service sheets, covering British receivers which have been sold in big quantities and which every service engineer is ultimately bound to meet. The following makes are included: Aerodyne, Alba, Bush, Cossor, Ekco, Ever-Ready, Ferguson, Ferranti, G.E.C., H.M.V., Kolster-Brandes, Lissen, McMichael, Marconi, Mullard, Murphy, Philco, Philips, Pye, Ultra. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Price £1 for the complete folder. **Our Folder No. 2** consists of 100 data sheets covering most of the popular American T.R.F. and superhet receivers "all dry" etc., which have been imported into this country. Names include Sparton, Emmerson Admiral, Crossley, R.C.A., Victor, etc. Each sheet gives circuit diagrams and component values, alignment procedure, etc., etc. Price for the folder of 100 sheets is £1. Post free.

INSTANT HEAT CONVECTOR

The heater with the lowest possible thermal capacity, 40ft. long; made from heavy gauge sheet steel (galvanised), 1 kw., suitable A.C. or D.C. Price only £2 or with thermostat £3/15/-. Note: The thermostat mounts separately and will control up to three heaters.

NOW—A.C. D.C. MULTI-METER KIT

The Multi-meter illustrated measures A.C./D.C. volts and D.C. m/amps and ohms. It has a sensitivity of 200 ohms per volt and is equally suitable for the keen experimenter, service engineer or student. All the essential parts including 2in. moving coil meter, selected resistors, wire for shunts, 8-point range selector, calibrated scale, stick-on range indicator and full instructions for making are available as a kit, price 19/6 plus 9d. post and packing.



BLANK CHASSIS
18 S.W.G. Aluminium

7 × 3½ × 2	3/9
9½ × 4½ × 2½	5/-
10 × 8 × 2½	5/6
10 × 5½ × 2½	5/-
12 × 9 × 2½	7/-
14 × 9 × 2½	7/6
14 × 10 × 3	7/9
16 × 10 × 3	8/3
16 × 12 × 3	8/6
19½ × 9 × 2½	8/3
20 × 10 × 3	10/-

CABINETS FOR ALL

We confidently believe we carry the best stock of cabinets in London. The one illustrated is The Bureau, a really beautiful cabinet elegantly veneered in walnut and finely polished. The control board is revealed when the front is dropped. Both radio board and motor board are left uncut to suit your own equipment. Price is **16 guineas**, carriage 12/6. We have many other types in stock. Pay us a visit, or send for Cabinet List.

BATTERY 3-VALVER 19/6

This employs a modern circuit which ensures good reception on both medium and long waves—all the parts including valves, resistors, tuning condensers, in fact everything except loudspeaker, cabinet, and metal chassis (you may already have something suitable, from an old receiver for instance), will cost you only **19/6**. Data available separately price 1/6.

ALL-DRY BATTERY BARGAIN

90 volt 3-pin ping type layer built battery by famous maker—recent manufacture—approximate dimensions 2¾in. × 2in. × 2¼in.—price 5/-, e.g. approximately half list—post and packing 9d.

THIS CABINET FREE

This month we are giving free a very fine modern portable cabinet to all purchasers who buy both the Truvox Tape Deck and the Cleveland Wide Band Amplifier. These three items will all fit together and make an extremely good tape recorder. Prices are as follows:—Truvox Tape Deck Mark IIIU, the very latest model, price £23/2/-. Cleveland Wide Band Amplifier, designed in conjunction with Truvox engineers to get the very best results from their fine deck, price £15, or £38 the two. Hire Purchase terms, send deposit of £4 or over, balance will be spread over twelve months—carriage, packing, and insurance 12/6 on the two items.

SENT FOR 15/- ONLY

This cabinet is offered below cost. It is suitable for a televisor using tube sizes varying from 12in. to 17in., its overall dimensions being 3ft. 5in. high, 1ft 4in. deep, 1ft. 10in. wide. It is complete with plywood back and "Bowler Hat." Originally made for a very expensive televisor and really good quality. Unrepeatable. Offered at £7/5/-, carriage, packing, etc., 12/6. Note: These are cut for 12in. tubes, but the holes for the controls are not drilled.

PRICE CORRECTION

We regret that an error occurred in our January advertisement—the Elpreq Tape Recorder was incorrectly priced, it should read 29 guineas, not 35 guineas.

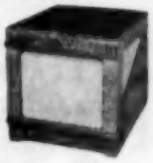
NEW YEAR BARGAIN

MINI-MAINS FOUR

Uses a 4-valve circuit with high-efficiency coils—covers long and medium wave bands and fits into the neat white or brown Bakelite cabinet—limited quantity only. All the parts, including cabinet, valves in fact, everything, £3/19/6 plus 2/- post. Constructional data free with the parts or available separately 1/6.

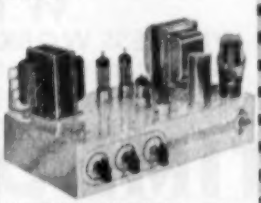
CABINETS 19/6

You can make an excellent bass reflex cabinet with this well made veneered and polished walnut cabinet. Limited quantity offered at **19/6**. Carriage, 6/6, 3/6.



NOBLEMAN GRAM

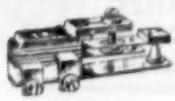
A 70 Gn. RADIOGRAM direct from makers for only 40 Gns. Or £4 deposit. A beautiful piece of furniture yet a most up-to-date radiogram—figured walnut lined sycamore—radio raised to comfortable level—compartment for records—5-valve A.C. mains superhet, covers long, medium and short waves—all latest refinements, negative feed-back tone control, etc.—large multi-coloured edget dial—latest Collaro three-speed auto-changer with the famous "Studio" pick-up—plays all types of records perfectly. Free Delivery in London Area. Elsewhere £2.



MULLARD AMPLIFIER "510"

A High Quality Amplifier designed by Mullard engineers. Robust high fidelity with a power output exceeding 10 watts and a harmonic distortion less than .4%, at 10 watts. Its frequency response is extremely wide and level being almost flat from 10 to 20,000 C.P.S.—three controls are provided and the whole unit is very suitable for use with the Collaro Studio and most other good pickups. The price of the unit completely made up and ready to work is £12/10/- or 25/- deposit, plus 10/- carriage and insurance. Alternatively, if you wish to make up the unit yourself we shall be glad to supply the components separately. Send for the Mullard amplifier shopping list.

NEW 5 AMP. THERMOSTAT (MINIATURE)



2¼" × 1" × 1¼" high.

Useful for the control of appliances such as convectors, gluepots vulcanisers, hot plates etc. This thermostat is adjustable to operate over the temperature range 50-550 deg. F., fitted with heavy (5 amp. A.C.) silver contacts size 1¼in. long × ½in. wide, price 8/6, post 6d.; 3 amp. type, 3/6, 7 amp. type 5/6.

ELECTRONIC PRECISION EQUIPMENT LTD.

249, Kilburn High Road, Kilburn. (Now Open.)

42-46, Windmill Hill, Ruislip, Middlesex. Phone: RUISLIP 5780 Half-day Wednesday.

152-153, Fleet Street, E.C.4. Phone: CENTRAL 2833 Half-day Saturday.

29, Stroud Green Road, Finsbury Park, N.4. Phone: ARCHWAY 1049 Half-day Thursday.

Postal orders should be marked "Dept. 2" and addressed to our Ruislip dept.

Photograph kindly supplied by The Radio People Ltd., Hong Kong.

HIGH FIDELITY IN THE FAR EAST

OMNI-DIRECTIONAL *3-Speaker System* W15/CS SUPER 8/CS SUPER 5

Treble Units Facing Upwards—Crossover Frequencies 800 and 5000 c/s.

This superb speaker, used here for a record recital at King's College, Hong Kong, has the W15/CS as bass speaker with fundamental resonance below 30 C/S; the Super 8/CS as middle speaker; and the Super 5 as third speaker with response well maintained to 16,000 C/S. The middle and top speakers, fitted with a volume control, face upwards to avoid undue directional effects.

PRICES (Tax free)

W15/CS sand-filled enclosure £47; Treble Assembly £18; HS/CR3 Crossover with V.C.s £8/10/-. Total price £73/10/-.

Wharfedale

WIRELESS WORKS LTD., IDLE, BRADFORD, YORKS.

Phone : Idle 1235/6 (2 lines) *Grams : Wharfdel, Idle, Bradford*

TIME DELAY *Unit*

THE 'GATLEY' ELECTRONIC TIMER

An Electronic Time Delay invaluable in many fields of Electronics and electrical engineering, e.g., process control, photographic exposure timing, etc. Time intervals range from 1/5th sec. to 1 min. In die-cast case suitable for wall mounting.

Write for Leaflet

F.C.ROBINSON

& PARTNERS LIMITED.

COUNCILLOR LANE · CHEADLE · CHESHIRE

MAKERS OF FINE INSTRUMENTS

Holley's

First Again with

SOMETHING NEW in HIGH-FIDELITY

Bearing in mind that room acoustics also are an important factor when perfection in Sound Reproduction is required, we are now in a position to demonstrate ***IN YOUR OWN HOME*** the latest High-fidelity equipment by the following makers.

ACOUSTICAL, LEAK, PAMPHONIC, SOUND SALES, GOODMANS, WHARFEDALE, CHAPMAN, TANNOY, ROGERS, GARRARD, W.B., GRUNDIG, BARKER, LOWTHER, CONNOISSEUR, ARMSTRONG.

Phone, call or write stating type and makes of equipment you are interested in.

This offer only applies at present to the greater London area but is shortly being extended to the provinces, also we still hold **SIDE BY SIDE DEMONSTRATIONS** of the above makers' products at

HOLLEY'S RADIO

285, CAMBERWELL ROAD, LONDON, S.E.5.

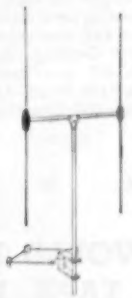
Telephone : RODNEY 4983.

HIRE PURCHASE TERMS. AFTER SALES SERVICE.

Aerials for everyone!

THE ANTIFERENCE RANGE COVERS ALL TYPES OF INSTALLATION AT PRICES YOUR CUSTOMERS CAN AFFORD TO PAY

X4L *Chimney lashing 6ft. mast for vertical mounting* 75/-.
Wall mounting Model X4W 66/6.
10ft. mast chimney lashing Model X4M 115/-.
Mast head mounting Model X4P 40/-.



LD7R *½ wave spacing; 6ft. mast* 79/6.
½ wave spacing; 10ft. mast Model LP7M 124/6.
½ wave spacing; 12ft. mast double lashing Model PD7RM 168/-.

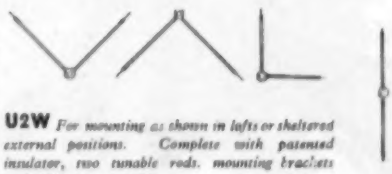
FD73 *Three element array for chimney lashing. Complete with 12ft. mast and double lashing equipment type LSG* 210/-.
As FD73 but less mast and lashing equipment Model FDH73 91/6.

FD74 *Four element array complete with 12ft. mast and double lashing equipment type LSG* 231/-.
As FD74 but less mast and lashing equipment Model FDH74 112/6.

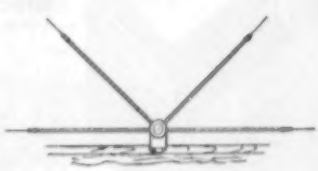
LD7 *Single Dipole with 3ft. swan neck mast and chimney lashing equipment* 48/-.
As LD7 but with wall mounting bracket Model WD7 39/6.

SDU7 *Single Dipole with ample stand-off Arm and Universal Bracket for surface mounting in a horizontal or vertical position* 32/6.

U2RC *A tunable "De Luxe" Room Aerial with patented insulator; cream plastic sleeved rods complete with 15ft. cream coaxial cable* 21/-.
Model U2R (as U2RC but less cable) 15/-.



U2W *For mounting as shown in lofts or sheltered external positions. Complete with patented insulator, two tunable rods, mounting brackets and fixing screws* 16/6.



UV4 *The most powerful loft aerial obtainable. Complete with patented insulator, four tunable rods, mounting brackets and fixing screws* 22/6. *Available for HORIZONTAL mounting as an X array* 25/-.

ANTIFERENCE LIMITED

Sales Division: Bicester Road, Aylesbury, Bucks. Tel. Aylesbury 1467/8

DEB/A/15

An audio frequency triumph!

95 GNS
(less microphone).
Wide-range Grundig Ribbon Microphone **12 gns.** *Grundig Moving Coil Microphone* **6 gns.** *Attractive Hire Purchase Terms.*

GRUNDIG TK 819
THE PORTABLE TAPE RECORDER WITH 40 c.p.s. to 14,000 c.p.s. FREQUENCY RANGE

SUPERBLY designed and engineered by Tape Recorder specialists. Two tape speeds (3¾in./sec. and 7½in./sec.) for 2 hours' speech or one hour's music recording per spool of tape. Automatic stop at end of spool. Fast forward or rewind time (2 minutes per full tape of 1,200ft.). Built-in precision place indicator, recording level meter by magic eye. Built-in pockets for 2 spare spools and microphone. Most Radio and Photographic Dealers stock Grundig. Ask for a demonstration or write for folder with full specification—**Grundig (Gt. Britain) Ltd., Kidbrooke Park Road, London, S.E.3.** (Electronics Division, Gas Purification & Chemical Co. Limited.)

★ ★ ★ ★ ★ ★ ★

GRUNDIG

THE WORLD'S FINEST portable TAPE RECORDERS

U.K. Agents: The SOLARTRON ELECTRONIC GROUP LTD. THAMES DITTON, Surrey.

METRIX

The entire range of electronic and electrical test apparatus manufactured by the Internationally famous

Companie Générale de Métrologie

of Annecy, France can now be obtained from the exclusive U.K. Agents,

The Solartron Electronic Group Ltd., of Thames Ditton, Surrey.

Telephone: EMBerbrook 5611

SOLARTRON

A NEW TECHNIQUE IN HIGH SPEED WAVEFORM MONITORING

BANDWIDTH :
10 kc/s to 300 mc/s

INPUT IMPEDANCE OF EACH PROBE :
Approx. 1 pf (input element of variable capacity divider)

MAXIMUM SENSITIVITY :
Full Scale Deflection for 1 Volt input

TIME SCALE :
Variable from .05 microsecs to 5 microsecs

RECURRENCE RATE OF MONITORED WAVEFORM :
100 c/s to 10 kc/s

CALIBRATION :
Provision is made for accurate measurement of time and voltage scales of a waveform

PREVENTION OF JITTER :
A circuit is incorporated for providing a stable display when a monitored waveform is jittering with respect to its driving pulse.

HIGH SPEED RECURRENT WAVEFORM MONITOR TYPE 500

The wide bandwidth and high sensitivity of the instrument as well as the very high input impedance result from the use of a sampling technique. During each recurrence a measurement is made of the instantaneous amplitude of one point in the waveform. This measurement is amplified and applied to the cathode ray tube as one co-ordinate of a graph of the waveform. During subsequent recurrences, instantaneous measurements are made of different points, resulting, after about 100 recurrences, in a complete graph.

Please write for further information.

METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER 17

Member of the AEI group of companies

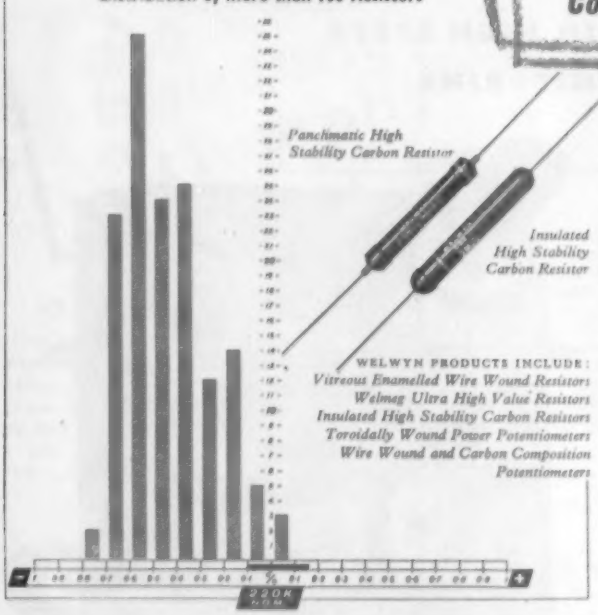
Leading Electrical Progress

4408

R. E401

C23'220K±1%

Distribution of more than 100 Resistors



Consistency of Performance

Study a moment this histogram. It is conclusive proof of the very high standards that prevail at Welwyn Electrical Laboratories. In graphic form it depicts the results of a test that our High Stability Carbon Resistors regularly undergo. Taken from the production line a representative selection of over one hundred resistors type C23/220K ±1% were tested to find out how their resistance values were distributed inside the tolerance of —1% to +1% of the nominal. The results are worthy of notice for they show that the resistance values were well within only half the marked tolerance. In time all cracked carbon resistors tend to drift towards an increased value, but, as you can see, the bulk of the distribution here is grouped below the nominal and this ensures that over their long life Welwyn Resistors remain accurate and within tolerance.

WELWYN PRODUCTS INCLUDE:
Vitreous Enamelled Wire Wound Resistors
Welmeg Ultra High Value Resistors
Insulated High Stability Carbon Resistors
Toroidally Wound Power Potentiometers
Wire Wound and Carbon Composition Potentiometers

MANUFACTURERS OF WELWYN ELECTRICAL COMPONENTS

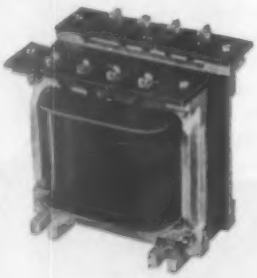
WELWYN ELECTRICAL LABORATORIES LTD · BEDLINGTON · NORTHUMBERLAND *On Admiralty, Ministry of Supply (A.I.D. Approved) & Post Office Lists*

STL

TRANSFORMERS
for POWER SUPPLIES and AUDIO FREQUENCY

A.I.D. Approved.

Suitable for use in all electrical and electronic equipment, to Ministry, B.S.S. or commercial standards. Tropical or standard finish.



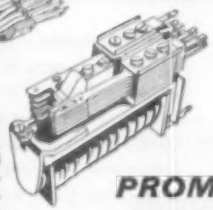
Enquiries from manufacturers and the trade only.

Quotations sent upon receipt of specifications or drawings.

STEWART TRANSFORMERS Ltd.
75 KILBURN LANE, LONDON, W.10
Tel: LADbroke 7196/7

RELAYS

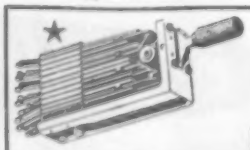
P.O. TYPES TO YOUR SPECIFICATION



3000 TYPES

1Ω to 80,000Ω COILS 1 Make to 8 c/o CONTACTS. 600 and HIGH-SPEED TYPES also Supplied.

PROMPT DELIVERY



LARGE STOCKS OF KEYSWITCHES

THE KEYSWITCH CO.

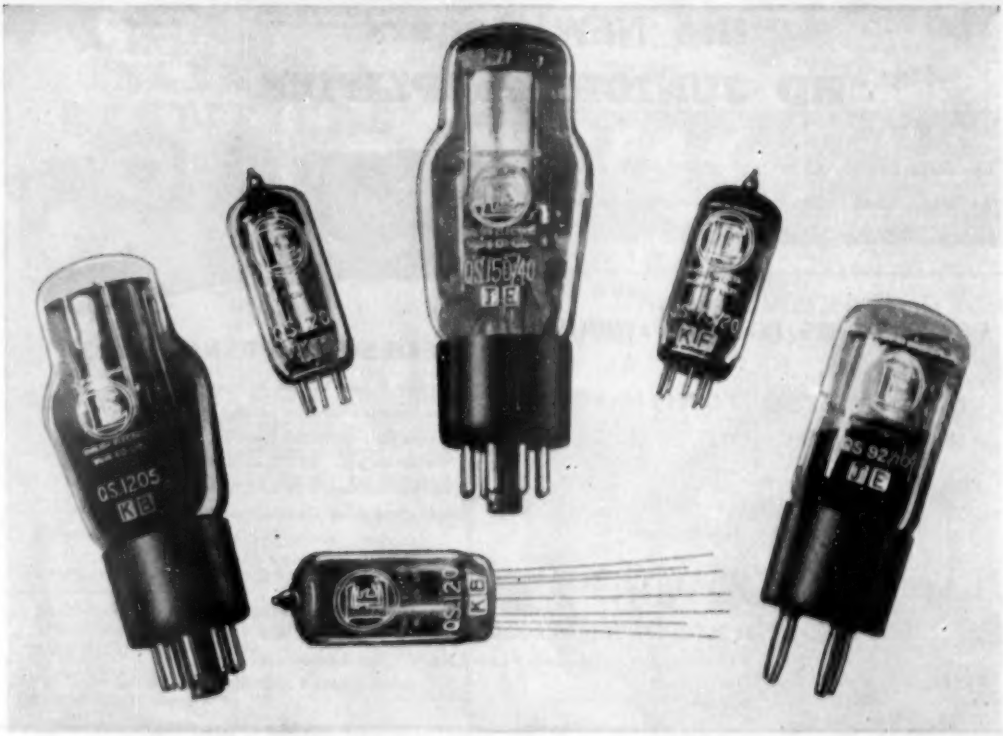
ALL POST OFFICE EQUIPMENT

★ *Please note change of address* ★

126 KENSAL ROAD, LONDON, W.10

Telephone: LAD. 0666

ENGLISH ELECTRIC VALVE COMPANY LIMITED



Voltage Stabilisers

ENGLISH ELECTRIC VALVE COMPANY make the largest range of gas filled voltage stabilisers in this country.

ENGLISH ELECTRIC VALVE COMPANY possess wide experience in production to fine limits which is your assurance of high quality products.

ENGLISH ELECTRIC VALVE COMPANY voltage stabilisers satisfy all requirements for reliability, and British Service types are fully approved.

Whether your needs are for General, Rugged or High Stability type valves, make sure before completing your specifications that you have full details of all English Electric Valve Company products.

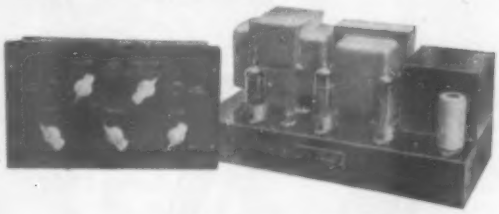
Write to :

ENGLISH ELECTRIC VALVE COMPANY LIMITED

WATERHOUSE LANE • CHELMSFORD • ESSEX

In stock at Webb's Radio
the *NEW* Rogers
"RD JUNIOR" AMPLIFIER

This 1955 design offers unapproachable value, the specification rivals amplifiers costing double its price of **£25**



★OR ON WEBB'S EXTENDED PAYMENTS
DEPOSIT **£5**, FOLLOWED BY 12 MONTHLY PAYMENTS OF **£1 : 16 : 8** OR 18 MONTHLY PAYMENTS OF **£1 : 5 : 7.**

A 12-page descriptive booklet is yours for the asking from

HERE ARE SOME OF ITS MANY FEATURES :

Two radio inputs, selected on control panel.
Pre-set volume control on pick-up input.
Low pass filter adjustable from 5 to 9 kc's and OFF.
8-10 watts output. 0.12% distortion at 8 watts.
Frequency response 0.25 d.b., 20-30,000 c/s.
Ample spare power for feeder units.

WEBB'S Radio
14 SOHO STREET, OXFORD STREET, LONDON, W.1
Tele: GERrard 2089. Shop Hours: 9 a.m.—5.30 p.m. Sats. 9 a.m.—1 p.m.

For

SPRINGS
SPECIALITIES
WIRE WORK
METAL PRESS WORK

Consult

HEATH SPRING & NOTION COMPANY LIMITED
BIRCHFIELD ROAD, HEADLESS CROSS REDDITCH

Telephone : Redditch · 861 · 862

ALWAYS "FIT"

AUTOSET

CASTORS
THE WORLD'S BEST
CONTRACTING TUBE ADAPTOR

For ⅞", 1", 1¼", 1½" tubes, Quickgrip Adaptors are fitted by hand as no tools are required. 2", 2½", 3", and 4" wheels may be used.

Ask for Brochure *and pages 8, 25, 57.*

Numerous other types of head fittings available

Engineers, Patentees and Sole Manufacturers
AUTOSET (PRODUCTION) LTD.
DEPT. "H," STOUR STREET, BIRMINGHAM, 18
EDG. 1143 (3 lines). Estd. over 35 years.
Please mention "Wireless World"

for

SELENIUM RECTIFIERS

consult

ELECTRIX

WHETHER the need is for a single unit or a supply running into thousands . . . if it's a Selenium Rectifier that must fulfil critical requirements and maintain its characteristics over long periods . . . the answer is to be found with Electrix.

- **Electrix Rectifiers are characterized by their cool running and consistent long-life conformity to stated specification.**
- **Manufacturers, Traders and Electronic Engineers, send us your specific requirements.**
- **Your needs may possibly be met from "standard" types, or**
- **"To specification" models can be quickly prepared.**
- **Quotations by return . . . and deliveries a matter of days only.**
- **We welcome export enquiries.**

Here are some typical "standard" full-wave types

		each
Output 12/15 Volts D.C. 1 Ampere.	List Price	9/-
Output 12/15 Volts D.C. 2.5 Ampere.	,,	13/6
Output 12/15 Volts D.C. 4 Ampere.	,,	22/6
Output 12/15 Volts D.C. 6 Ampere.	,,	35/-

Trade Supplied

- **Heavy duty rectifiers with say 230/250 volts A.C. input and 220 volts D.C. output a speciality.**
- **We use only freshly manufactured selenium plates and components, no ex-W.D. materials whatsoever**

HOUSEHOLD ELECTRIX LTD

47-49 HIGH ST., KINGSTON-ON-THAMES

Telephone: KINgston 4585

L·R·S

Estd. 1925

EASY TERMS

LEAK QUALITY EQUIPMENT *for the Connoisseur*

The amazing New
"TL/10" AMPLIFIER and
"POINT ONE" PRE-AMPLIFIER

SENT FOR 60/- DEPOSIT

This 10-watt amplifier maintains, in every respect, the world-renowned LEAK reputation for precision engineering, fine appearance, and fastidious wiring. The Pre-amplifier will operate from any well-known pick-up, whether crystal, moving iron or moving coil. Provision is made for Tape Recorder and Play back and, as an exclusive feature, readily accessible jacks are provided on the front panel for instantaneous use.

See maker's advt. p. 95 for full technical specification.

The total Cash Price for these Two Units is £28.7.0. Our NEW EASY TERMS are £3 Deposit with order and 14 monthly instalments of 40/- (carriage and crate free).

If you require FINEST QUALITY REPRODUCTION together with WORKMANSHIP of the HIGHEST ORDER your choice must be

★ LEAK ★

THE VERY LATEST

LEAK DYNAMIC PICK-UP

complete with two detachable diamond heads and transformer is now available from stock. **Cash price £20.19.9,** or sent for £3 deposit and 10 monthly Payments of 40/-. Post paid.

The L.R. SUPPLY COMPANY LTD.

BALCOMBE Telephone: Balcombe 254 **SUSSEX**

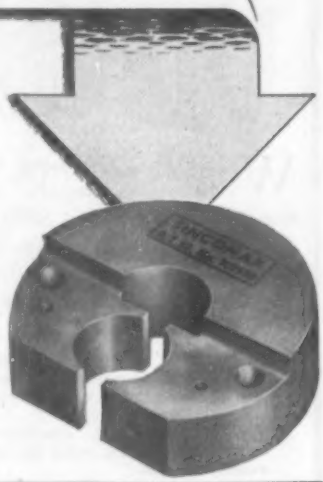
MUREX 'SINCOMAX' MAGNETS

ARE USED IN

E.I.C. INSTRUMENTS

Photograph by courtesy of E.I.C. (Hillington) Ltd., Glasgow

The high magnetic stability and strength of 'Sincomax' magnets makes a robust job even of a sensitive Microammeter. In this application as in many others Murex Sintered Magnets continue to give accurate and reliable service.



MUREX LIMITED *(Powder Metallurgy Division)*
RAINHAM • ESSEX • *Rainham, Essex 3322*
London Sales Office: Central House, Upper Woburn Place, W.C.1. *Euston 8265*

Smith's for Technical Books

Books on the theory and practice of electronics, new developments, circuit design, and other specialized subjects can be quickly supplied through your local Smith's shop or bookstall.

Your copies of WIRELESS WORLD can be bound into attractive volumes; and all your stationery and printed matter supplied through our local branch.

W. H. Smith & Son
for **SPECIALIZED BOOKS**
HEAD OFFICE: STRAND HOUSE, LONDON W.C.2

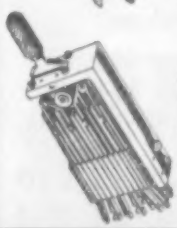
MANUFACTURERS
of
MAGNETIC RELAYS
POST OFFICE TYPE

3,000 and 600

Contractors to:
H.M. GOVERNMENT AND LEADING MANUFACTURERS

COILS up to 80,000Ω.
CONTACTS up to 8 amps.
INSULATION up to 5 kV.

Specialists in Tropicalisation and Inter Services Jungle Finish.



Conforming to A.I.D. and C.I.E.M.E. standards.

PROTOTYPE Relays made to specification.

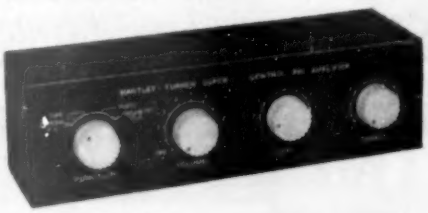
POST OFFICE TYPE KEYS supplied to specification.

Speedy deliveries
Enquiries invited

A.D.S. RELAYS LTD. Dept. W.W.
12, STORE STREET, LONDON, W.C.1.
Tel.: MUSeum 2453.

HARTLEY-TURNER SOUND EQUIPMENT

We should like, once again, to draw attention to the Hartley-Turner Super Control Preamplifier.
This is designed to feed the output from Tape Recorders, Crystal and Magnetic Pick-ups and Radio Tuning Units to the main amplifier.
Employing sub-miniature valves and highest quality components throughout, this unit combines efficiency with simplicity of operation, reliability and compactness.



Brief Specification :

4 switched input channels. Input sensitivity: 1V positions 1 and 2; 25 mV positions 3 and 4, for 1V R.M.S. output. Cathode follower output stage. Separate continuously variable Bass and Treble controls: Bass variable 0db to +25db at 40 c/s: Treble variable —10db to +10db at 10 Kc/s.

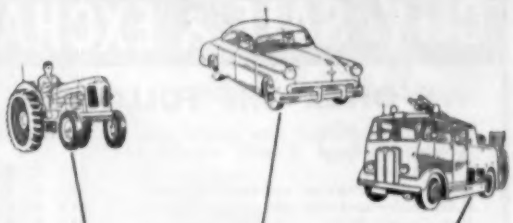
Power required: 250V DC 3mA
6.3V 0.9A

Whole unit completely screened and enclosed in case 10⅞ x 3½ x 3¼in.

PRICE: £8 . 18 . 6

Full particulars sent free and post free on application to :

H. A. HARTLEY CO. LTD.,
152, HAMMERSMITH ROAD,
HAMMERSMITH, LONDON, W.6.
Telephone : RIVerside 7387



RADIO TELEPHONE SYSTEMS

The Hudson range of highly efficient and economically operated two-way communication systems comprises equipment applicable to various requirements in all countries.

Consult **Hudson** OF LONDON

LIST OF MODELS

AM/250/M...	6 watt Vehicle Station, 60 to 100 Mc/s.
AM/150/M...	5 watt Vehicle Station, 100 to 185 Mc/s. Single or up to 5 channels.
AM/250/F ...	6 watt Fixed Station, 60 to 100 Mc/s.
AM/150/F ...	6 watt Fixed Station, 100 to 185 Mc/s. Single or up to 10 channels.
FM.102	10 watt FM Vehicle Station, 60 to 185 Mc/s. Single or up to 4 channels via remote control.
FM.101	10 watt FM Fixed Station, 60 to 185 Mc/s. Single or up to 10 channels.
HED.113 ...	50 watt AM or FM Fixed Station, 60 to 185 Mc/s. Up to 4 channels via remote control.

Supplied to the G.P.O. and Home Office.

HUDSON ELECTRONIC DEVICES, LTD.
APPACH ROAD, LONDON, S.W.2
Telephone : TULse Hill 4861
Cables : HUDELECT, LONDON

CITY SALE & EXCHANGE LTD

The High Fidelity Specialists

WE OFFER THE FOLLOWING NEW MODELS FROM STOCK

Leak TL/10 amplifier with control unit.....	28 guineas
Acoustical Quad II with control unit, 12-15 watts	£42 0 0
R.D. Junior amplifier and control panel	£25 0 0
R.D. Senior amplifier and control panel	£43 0 0
Pye 12-watt PF.91	£42 0 0
Lowther P.73 corner speaker	£96 0 0
Wharfedale treble assembly	£73 10 0
R.D. Junior corner horn with Wharfedale super 8 unit	£25 10 0
Salex sandfilled corner baffle with Wharfedale super 12 CS/AL unit.....	£28 0 0
Salex 12in. reflex cabinet with Axiom 150 March II unit	£20 10 0
Garrard RC.80M auto gram unit, complete with G.C.2 head	£17 9 6
Garrard TA non-auto unit, same head	£10 16 0
Collaro 3 RC.554 non-auto unit with turn-over studio p.u.	£8 18 11
Collaro studio pick-up, complete with arm and 2 sapphires	£3 14 8
Collaro studio pick-up, complete with arm and 2 sapphires, with L.P. diamond extra...	£7 5 0
Liak dynamic pick-up, 2 diamond heads, transformer, complete	£20 19 9
Acos GP.20 pick-up with 4 GP.39 head.....	£3 8 8
Extra heads ..... each	£2 2 3

PART EXCHANGE

arranged. Write or 'phone for offer. Cabinets made to order.

EASY PAYMENTS

with 20% deposit, and the balance over 18 months.

Write for our bi-monthly second-hand list

Reconditioned Stock

Quad I amplifier and control unit	£22 0 0
Gramophone amplifier, complete	9 guineas
Quad four station pre-set tuner	14 guineas
Decca PA.6 push-pull portable amplifier, metal case, mike and gram.	14 guineas
Wharfedale loudspeaker tone control and microgroove equaliser	£1 10 0
Wharfedale Super 5 C/S AL unit on baffle.....	£5 0 0
R.D. 4-station M/W pre-set tuner.....	7 guineas
Phase-in Invicta unit	3 guineas
E.M.G. steep cut filter, 3 ohm.	£3 10 0
B.S.R. 2-speed motor mounted on board with 2 Decca magneto p.us.	£6 10 0
B.S.R. MU.12, 78 or 33 motor	£3 15 0
B.S.R. 2-speed gram. motor mounted on board with turn-over Decca X-tal p.u.	£3 10 0
Plessey 3-speed auto gram unit	7 guineas
Wharfedale 8in. speaker cabinet	£2 10 0
Truchord 50T amplifier in handsome case with speaker	19 guineas

93-94 FLEET STREET, LONDON, E.C.4 *Phone: CENtral 9391/2*

DID YOU KNOW ?

More and more designers are specifying our products, the latest being in "RADIO CONSTRUCTOR'S" '*GLOBE-MASTER*,' an 8-valve communications receiver for the Home Constructor. Others have been "PRACTICAL WIRELESS" '*CORONET FOUR*,' '*AC/DC CORONET*' and '*BATTERY CORONET*,' etc. As a discriminating constructor **YOU** cannot do better than by sending 2/6 (plus 3d. post) **TO-DAY** for the **NEW** 1955 issue of our famous publication.

RODING'S "HOME CONSTRUCTOR'S HANDBOOK"†

which contains 70 pages of blueprint circuits, parts lists and technical descriptions of our 22 guaranteed outfits. Also included are set building and servicing hints, facts and formulae, resistance colour code, data, etc., etc., and our current Catalogue. Remember

YOU REQUIRE NO TEST GEAR TO BUILD OUR SETS!

We can supply *FREE* **FULL SIZE** working drawings (see Handbook for full details), and nothing is left to chance. All parts supplied by us are fully identified and our tuning units are completely pre-aligned.

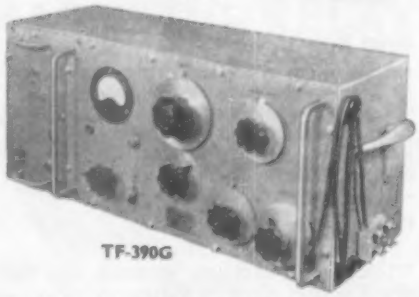
†*Also obtainable at leading booksellers and component stockists.*

RODING LABORATORIES

(Dept. W2), BOURNEMOUTH AIRPORT, CHRISTCHURCH.

UNIVERSAL ELECTRONICS

Amazing Sale of



TF-390G

MARCONI SIGNAL GENERATORS TYPE TF-390G

Frequency range — 16-150Mc/s. In first class operating condition. Laboratory checked **£25**

Transport extra at cost.

NOTE: Also available **BRAND NEW** (ex-M.O.S.) in original transit cases with full spares. **£35**

Transport extra at cost.

A really unrepeatable opportunity.....*Act promptly.*

22, LISLE STREET, LONDON, W.C.2.

OPEN ALL SATURDAY. *9.30 a.m.-6 p.m. Thursdays: 9.30 a.m.-1 p.m.*

Telephone: GERrard 4447 and 8410 (Day) : MEAdway 3145 (Night).

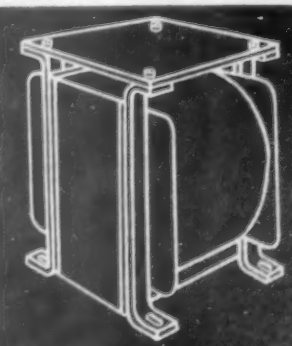
RADIO EXPORT TUBES ONLY

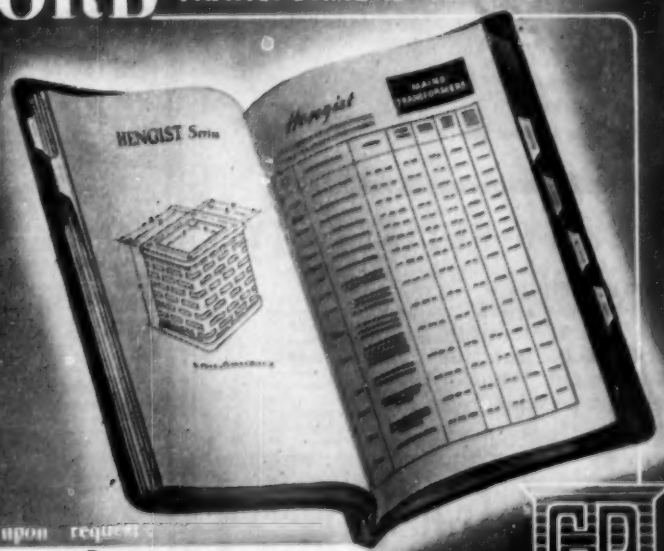
1,000 types of Receiving and Transmitting Radio Tubes available ex stock.

HALL ELECTRIC LTD
Haltron House, 49-55 Lisson Grove, London, N.W.1.
Tel.: Ambassador 1041 (5 lines) Cables: Hallectric, London

SOMERFORD TRANSFORMERS AND CHOKES

A range of 360 standard types available for "off the shelf" delivery in several different mounting styles including both open and hermetically sealed "C" cores.





Fully descriptive Catalogue upon request

GARDNERS RADIO Ltd

GR

SOMERFORD CHRISTCHURCH HANTS *Tel: 1024/5*

MODERN ELECTRICS LTD.

164 Charing Cross Road, London, W.C.2.

Tel.: TEMple Bar 7587.
Cables: Modcharex, London.

Export enquiries welcomed. *Immediate delivery from stock.* *Prompt attention to post orders.*

TAPE RECORDERS

GRUNDIG 819	£99 15 0
GRUNDIG TK9	£68 5 0
FERROGRAPH 2AN	£79 16 0
VORTEXION 2A	£84 0 0
EDITOR	£47 5 0
PLAYTIME	£31 4 6
WEARITE TAPE DECKS Type A and B	

RECORDING TAPES

GRUNDIG	
L.G.S. 1,200ft.	£2 0 0
850ft.	£1 14 0
600ft.	£1 5 0
FERROVOICE	
1,200ft.	£1 2 6
Spare Spools	4 6
E.M.I. type 88, 1,200ft.	£1 15 0
E.M.I. type 88, 600ft.	£1 1 0
GEVAERT	
1,200ft.	£1 15 0
SCOTCH BOY	
1,200ft.	£1 15 0
600ft.	£1 1 0
Spare Spools, 1,200ft.	4 6
Spare Spools, 600ft.	2 6
FERROGRAPH	
1,200ft.	£3 5 0
1,750ft.	£3 3 0
8½in. Spools	9 6
AGFA	
1,200ft.	£1 17 6
600ft.	£1 2 6
Lead on tape 150ft.	8 0

RECORD REPRODUCING EQUIPMENT

COLLARO TRANSCRIPTION	
Model 2000	£13 9 6
Model 2010	£10 6 6
GARRARD UNITS	
RC80M A.C.	£19 6 7
RC80M A.C./D.C.	£28 0 6
301 Transcrip.	£25 3 6
Type TA/AC	£10 16 0
Type TA/B with Decca heads	£14 0 11
CONNOISSEUR	
3-spd.	£23 8 11

SPEAKERS

W.B. STENTORIAN	
HF.610	£2 10 6
HF.810	£3 0 6
HF.912	£3 7 0
HF.1012 capped coil, 3, 7.5 or 15 ohms	£3 17 6
GOODMANS	
Axiom 150 Mk. II	£10 5 6
Axiom 102	£9 18 2
Axiom 101	£6 13 1
WHARFEDALE	
W15 CS	£17 10 0
Super 12 CS/AL	£17 10 0
W12 CS	£9 15 0
Goldan 10 CSB	£8 6 7
Super 5 and 8 CS/AL	£6 13 3
Bronze 10in.	£4 12 9
Bronze 8in.	£3 4 0
W.B. Crossover Unit	£1 10 0
W.B. Tweeter Unit	£4 4 0

TEST EQUIPMENT

AVO	
Model 8	£23 10 0
Model 7 (latest)	£19 10 0
Uniminor Mk. II	£10 10 0
Electronic Meter	£40 0 0
Wide Band Sig/Gen.	£30 0 0
Valve Characteristic Meter (New Type)	£60 0 0
D.C. Minor	£5 5 0
10kV Multiplier for Model 8	£3 5 0
Carrying Cases for Models 7 8 and 40	£3 0 0
ADVANCE	
H.1 (Sig/Gen)	£25 0 0
E.2 (Sig/Gen)	£28 0 0
J.1 New Model	£35 12 0
P.1	£19 19 0
COSSOR	
Oscilloscope 1035	£120 0 0
Oscilloscope 1052	£184 0 0
Volt: Calibrator 1433	£18 5 0
TAYLOR	
All new Taylor Test Gear in stock.	

PICK-UPS

ACOS H G 20	£3 8 4
DECCA	
X.M.S. Magnetic	£6 9 5
CONNOISSEUR	
Super L/weight	£9 5 6
Spare Heads	£3 6 3
COLLARO STUDIO	
Type O or P	£3 14 8
LEAK	
2 Heads with Diamond Stylus	£20 19 9

MICROPHONES

ACOS	
Mic 22 (Crystal)	£4 4 0
Mic inserts for above	£1 0 0
Mic 16 (Crystal)	£12 12 0
Mic 35-1 (Crystal)	£1 5 0
LUSTRAPHONE	
M/C with T/P CS1	£5 15 6
Table base for above	£1 1 0
RESLO M/C (Low Imp.)	£6 0 0
URA Ribbon	£7 5 0
RVA Ribbon	£9 0 0
FILM INDUSTRIES	
Ribbon	£10 0 0
MICROPHONE STANDS	
Floor, 3 extensions	£3 12 6
Table Stand	£1 5 0
LEAK AMPLIFIERS	
TL.10 complete	£28 7 0
Point 1, TL.12	£28 7 0
Point 2, TL.25	£34 7 0
QUAD Mk. II	£42 0 0
SOLON. New Instrument Iron 200-250 v. 25 w.	19 8

ALL GARRARD, CONNOISSEUR, DECCA and COLLARO HEADS, SAPPHIRE and DIAMOND STYLI for the above HEADS NOW AVAILABLE.

Transformers
Transformers
Transformers

QUALITY-RELIABILITY

For the Mullard Amplifier.
For the Osram 912 Amplifier.
For the Williamson Amplifier.
C. R. Tube Isolation Transformers.
Instrument Transformers,
and all popular types.

FROM

Ellison Transformers

LIMITED

62, BRIDGE ST. NORTHAMPTON

AND ALL LEADING COMPONENT DEALERS

SUPERIOR RADIO SUPPLIES

!!! CONSTRUCTORS !!!

OBTAIN "SUPERIOR RESULTS" WITH THESE RECEIVERS

THE SUPERIOR T.R.F. RECEIVER (BUILDING COST £7/5/-). Suitable for A.C. Mains 220/240 volts. Medium and Long Wavebands. Very attractive walnut veneered cabinet finished in two contrasting colours. All brand new components, available individually for the construction of this fine receiver. Valve line-up: 6BG7, 6BG7, 6V6gt, 6X5gt. Complete construction booklet for the SUPERIOR T.R.F. RECEIVER with theoretical and practical diagrams, also price list of recommended parts. Price 1/6 post free.

THE SUPEREX "ATTACHE" ALL DRY PORTABLE (BUILDING COST £7/15/-). A really superb 4 VALVE SUPERHET receiver, giving first-class results on both Long and Medium Wavebands. The cabinet is very compact (Size 11½in. × 8½in. × 4½in.) and of the attache case type, covered in twin colours of high quality leatherette. Weight of complete receiver less batteries 8lbs. All components used are of the highest grade: OSMOR HIGH Q COILS and FRAME-AERIAL, Plessey-Amplion Midget I.F.T.s. Provision is also made for 7in. × 4in. Elliptical Speaker. Valve line-up: 1R5, 1T4, 1S5, 3V4. Send for SUPEREX "ATTACHE" BOOKLET giving full building details and practical wiring diagrams. Price 1/6 post free.

THE SUPEREX UPRIGHT PORTABLE (BUILDING COST £7/15/-). Chassis assembly and components almost identical to attache model with the exception of the cabinet. This is of the upright model with large speaker aperture in the front, with dial and controls under lift-up lid in the top of cabinet. Also covered in twin colours of leatherette. Cabinet size: 10½in. × 8½in. × 4½in. Send for SUPEREX "UPRIGHT" BOOKLET, price 1/6 post free.

S.R. 5-6 WATT AMPLIFIER KIT (BUILDING COST £4/15/-). Designed on very attractive lines and incorporating Bass, Treble, Middle, and Volume controls. Suitable for most types of pick-ups. Chassis hammer-finished in mottled grey or bronze and given a professional finish with engraved control knobs. Complete with P.U. and L.S. panels, O/P Transformer, Mains Transformer, etc. Valve line-up: 6BG7, 6X5gt, 6V6gt. For A.C. Mains 210/240 volts. Send for S.R. AMPLIFIER LEAFLET giving complete home construction details. Price 6d. post free.
The above amplifier is available ready built and tested, price £5/5/- post free.

We have a large range of Radio and Television components and special purpose valves at very competitive prices.
TERMS: Cash with order or C.O.D. Extra charge for C.O.D. please add postage. (U.K. and N. Ireland only.)
OPEN: 9 a.m. to 6 p.m. Monday to Saturday, 1 p.m. Thursday.
PERSONAL CALLERS WELCOMED.

SUPERIOR RADIO SUPPLIES

37, Hillside, Stonebridge, London, N.W.10.
Phone: ELdor 5644.

WE PAY TOP PRICES

FOR

AMERICAN SURPLUS
ELECTRONIC EQUIPMENT

LOOK AT THESE EXAMPLES

For equipment in good condition

Receiver R54/APR4, complete	£200
Transmitter ET4336	£110
Test Set TS13	£100
Frequency Meter TS175/U	£80
Frequency Meter BC221	£26
Receiver BC348R	£25

We pay similar remarkable prices for

Receivers. R111/APR5, R5/ARN7, AR88D, BC348, ARN5.
Transceivers. ARC1, TCS, BC800, RT1/APN2.
Transmitters. T11/APN3, ART13.
Indicators. ID17/APN3.
Test Sets. Any unit with prefix "TS" also 1E19, 1-208, BC713A/BC714A.
Power Units. RA34, RA42, RA62, MG149, DM28.
Tuning Units. TN17, TN18, TN19, TN54, TU57, TU58, TU59.
Control Gear. BC1145, C45-ARC1, MR1B.

And almost every American-made unit even if not mentioned above.

Phone us immediately, transfer charge.

We have a vacancy for a technician who is conversant with American surplus equipment. Write or 'phone if such a job would interest you.

TO HAMS WHO CONVERTED BC348, BC342, BC312. Post to us the dynamotors and power units which you removed. We pay top prices for these, i.e. DM28, DM21, RA20.

TO OVERSEAS BUYERS

We have the largest stock in Europe of American Government surplus electronic equipment and we would be pleased to quote by return of post against your enquiries. The following are a few examples only of the equipment which we can supply from stock.

BC221	**Frequency Meter**
ET4336	**Transmitter.**
SCR720C	**Search Radar, complete, also separate units and spare parts.**
BC348	**Receiver.**

Deal with the firm that has been established for twenty-five years.

ALTHAM RADIO CO.

JERSEY HOUSE, JERSEY STREET
MANCHESTER 4

Telephone: **Central 7834/5/6**

TRUVOX

Introduce A NEW HIGH FIDELITY CORNER DIFFUSION SPEAKER

Designed for small and medium sized halls and for use in homes where quality is a vital factor.

The lower registers are reproduced with exceptional smoothness assisted by the bass reflex action of the corner cabinet. The high notes are brought out with brilliant clarity from the specially designed acoustic system.

The overall effect of this construction is to give life and extraordinary depth to the sound which thereby approaches a three dimensional quality and truly justifies the term "high fidelity." The technical excellence of this instrument is matched by its artistic conception as a piece of stylish furniture finished in walnut veneers.

Maximum handling capacity	12 watts
Speaker flux density	10,000 line.
Impedance	15 ohms
Height	32 inches
Maximum width	27 inches
Maximum depth	18 inches
Net weight	54 lbs.

PRICE:

CABINET Only (Pats. applied for)	£36	0	6
SPECIAL SPEAKER TO MATCH	£3	0	0
Plus Purchase Tax on Speaker	£1	0	6

TRUVOX LIMITED

HARROW · MIDDLESEX

Sales Office 15 Lyon Road, Harrow, Middlesex. *Telephone: Harrow 9282.*
Technical & Service Depts.: 320 The Broadway, Station Road, Harrow, Middlesex. *Telephone: Harrow 4455.*

A TRUVOX PRODUCT

LOCKWOOD

Standard Loudspeaker Cabinet

This new 'LOCKWOOD' model has been manufactured to meet the demand for a cabinet of high quality, and in conjunction with various loudspeaker units and high fidelity apparatus is capable of giving reproduction of a very high order.

*A vented design developed from the Monitoring Loudspeaker Cabinet used by The British Broadcasting Corporation (BBC. PAT. 696,671), this enclosure is, we believe, the sensible approach to the problem of providing good quality in the home at a reasonable price.

The combination of good materials and first-class workmanship is incorporated in a functional design, and this cabinet is acceptable in most furnishing schemes. It can be manufactured in exotic veneers additional to the almost traditional Oak, Mahogany or Walnut, or alternatively in coloured finishes, suitable for Broadcasting and Television Studios.

Two versions are available:—

Major Model **£35** Minor Model **£25**

A brochure, free on request, fully explains these new models and why they are supplied ready to assemble.

EXPORT & TROPICAL MODELS AVAILABLE.

Trade enquiries invited.

DEMONSTRATIONS BY APPOINTMENT ONLY.

* *"Wireless World," November & December, 1950.*

LOCKWOOD

Acoustically Designed Cabinets

LOCKWOOD & Co • LOWLANDS ROAD HARROW • MIDDLESEX

ASK ARTHURS FIRST

★ **NEW VALVES** Send your enquiries for all Radio and Electrical goods, especially those in short supply.

We have probably the largest variety of valves in the country. Let us know your requirements.

AVO METERS IN STOCK

Avo Model 7	£19 10 0
Avo Model 8	£23 10 0
Signal Generator, Mains and Battery Models	£30 0 0
Electronic Test Meter	£40 0 0
Valve Characteristics Meter	£60 0 0

Also full range **TAYLOR METERS.** List on request.

VALVE MANUALS

Mullard	5 0
Osram	5 0
Brimar No. 5	5 0
Mazda, Part 2	2 0
Mullard Valve Replacement Guide	2 6
Art and Science in Sound Reproduction by F. H. Brittain, D.F.H.	2 6

Postage 6d. each extra.

Leak TL/10 Amplifier and "Point One" Preamplifier complete	£28 7 0
Chapman Tuning Units	£17 6 8
Leak Tuning Unit	£35 6 3
Grundig Tape Recorder	£60 5 0
Grundig Microphone	£6 6 0

Recording Tapes: All makes in stock.

Terms: C.O.D. or Cash with order. Goods offered subject to being unsold and to price alteration.

Arthurs EST. 1919

PROPS: ARTHUR GRAY, LTD.

GRAY HOUSE, 150-152 CHARING CROSS ROAD, LONDON, W.C.2

TEMple Bar 5833/4 and 4765. Cables: TELEGRAY, LONDON

AUSTRALIA CALLS

TELECOMMUNICATION ENGINEERS

Rapidly developing, Australia urgently needs professionally qualified Engineers to assist in the expansion and maintenance of its national telephone, telegraph, radio and television services.

SALARY: From £890(A) to £1,262(A) per annum, depending on qualifications and experience.

CONDITIONS OF APPOINTMENT: Permanent appointment to the Postmaster-General's Department. Free passages for appointee and dependents. Initial accommodation provided. In approved circumstances, special settling-in allowances. Full salary from date of embarkation. Superannuation, generous annual and sick leave conditions. Good opportunity for advancement.

FOR FURTHER DETAILS: Engineers qualified or about to qualify electrical, mechanical and other sections enquire or forward the following coupon to the Australian Post Office Representative, Australia House, Strand, London, W.C.2.

Dear Sir,

Please send full details of the opportunity for Telecommunication Engineers in the Australian Post Office.

Name .....

Address .....

.....

HIVAC
THE SCIENTIFIC VALVE
BRITISH MADE

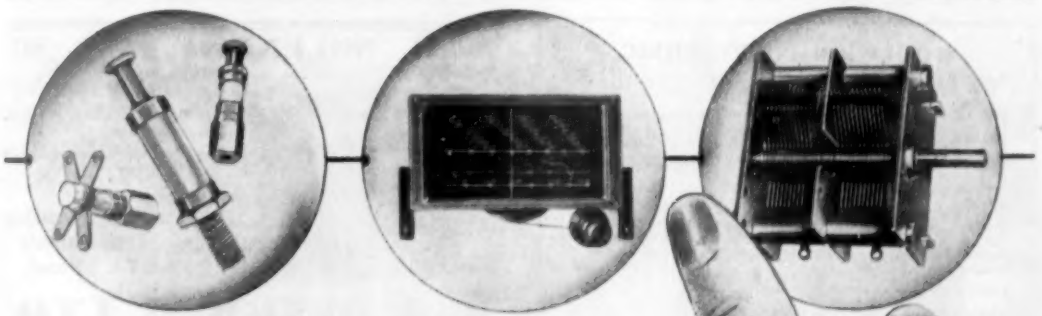
A NEW range of flat subminiature directly heated valves for use in radio-frequency equipment

TYPE	DESCRIPTION	U.S. EQUIVALENT	FILAMENT Volts	FILAMENT Ma.	Anode Volts	Screen Volts	Grid Volts	Anode Ma	Screen Ma	Mutual Conductance	Power Output
XFR1*	R.F. Amplifier	IAD4*	1.25	100	45	45	0	3.0	0.9	2 mA/V	
XFR2*	R.F. Amplifier	5678*	1.25	50	67.5	67.5	0	1.8	0.5	1.1 mA/V	
XFR3	H.F. Triode	5676	1.25	120	135		—5	4.0		1.65 mA/V	
XFY14	Output Pentode	5672	1.25	50	67.5	67.5	—6.5	3.1	0.95	0.65 mA/V	50 mW†

* Fully screened with metallized coating. † With input signal 4.55 V. A.C. and anode load 20 kΩ.

Hivac Ltd STONEFIELD WAY, VICTORIA ROAD, RUISLIP, MIDDLESEX Telephone: Ruislip 3366

V 10



You can count on these . . .
. . . for a reliable performance

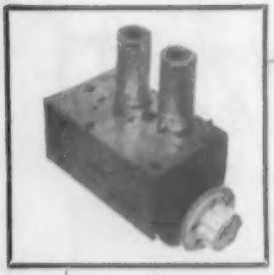
STAND-OFF INSULATORS. Working voltage 1,500/5,000. Very high insulating resistance. Ceramic non-tracking. Silicone treated to repel moisture (ideal for tropics). Tag or spill end. We have a full range to cover most needs.

S.L.8 SPIN WHEEL DRIVE. A precision slide rule drive complete with 3 band glass scale. The spin wheel drive gives perfect control through ratio 24 : 1. Fitted with constant velocity coupling, eliminating strain on condenser and providing mechanical and electrical isolation from vibration and noise.

M.G. GANG CONDENSER. Available as 1, 2 or 3 gang, 490 p.F. nominal capacity matched and standardised to close limits. Cadmium plated steel frame. Aluminium Vanes. Low loss non-hygroscopic insulation. Length excluding spindle: 1 gang—1 1/8in. to 3 gang —3 1/8in.
Price 1 gang, 9/3, 2 gang, 14/- 3 gang, 18/3.

Write for full details of the complete range of precision-built components for Radio and Television industry.

JACKSON BROS. (London) LTD., KINGSWAY · WADDON · SURREY
Telephone: CROydon 2754-5. *Telegrams*: WALFILCO, SOUPHONE, LONDON.



MULTI-CHANNEL

TUNERS

for

TV or FM

RECEPTION

These instruments have created special interest in the Trade. They have been specially developed for incorporating into new TV receivers, or for converting standard receivers for reception of Bands I, II and III. They utilise a cascode RF amplifier type PCC84, and a new valve PCF80 of the triode pentode type.

Power requirements :
H.T.:—170v. 25mA; Heater:—16·4 at ·3 amp;
A.G.C. lines:-5v. maximum.

Provisional price : **£6**

Please write for full details.

Valradio

VALRADIO LIMITED, NEW CHAPEL RD., HIGH ST., FELTHAM, MIDDLESEX. PHONE : FELTHAM 4242.

L.H.F. DEA.2503

IF **YOU** LIVE IN THE **NORTH** OF ENGLAND

LANCASTER HI-FIDELITY

HAVE THE MOST COMPREHENSIVE SELECTION OF QUALITY EQUIPMENT IN YOUR AREA

We are OFFICIAL Agents and Stockists for most leading makes of sound equipment and are in constant touch with the manufacturers.

AMPLIFIERS and Possings.
Acoustical Quad II.
Leak TL/10 and TL/12.
Pamphonic 1002
Rogers
Armstrong A10
Goodsell
Hartley Turner
Mullard 510
NEW Leak Varislope
G.E.C. 912

RADIO TUNER UNITS
Sound Sales
Chapman
New Quad
and many others.

RADIOGRAM CHASSIS
Burgoyne
Armstrong
Dulci

Gram PICKUPS
Ferranti Ribbon
Connoisseur
Decca "H"
Collaro Studio
Leak Dynamic
Acos Hi-g
Lowther Moving Coil
Goldring Variinetance
B.J. Arm

MOTORS
Connoisseur
Garrard
Collaro
Jasons

AUTO-CHANGE UNITS
Garrard RC 90
BSR Monarch
Collaro RC54

LOUDSPEAKERS
Wharfedale 3 Speaker Assembly
Tannoy Dual Concentric
Goodmans 2 speaker system
Barker Duode
Decca Corner
G.E.C. Metal Cone
Whiteley HF 1012
Sound Sales P.I.

In addition to the above speakers we stock:—
ALL the Wharfedale Range and
ALL the Goodmans range.

DEMONSTRATIONS daily from 11 a.m. to 5 p.m. (Saturdays to 2 p.m.). (Business hours 9.15 a.m. to 6.30 p.m.) Expert and experienced advice as to suitable choice of equipment.
SERVICE AFTER SALES by skilled engineers.
AUDIO FURNITURE produced by our Cabinetmaker to your design or ours.
Hire Purchase Terms if desired.

The North's Sound Reproduction Specialists

LANCASTER HI-FIDELITY ACOUSTICAL EQUIPMENT CO.,
27/29 Lancaster Avenue, Fennel St., MANCHESTER 4

WOOLWICH POLYTECHNIC

Principal : James S. Tait, Ph.D.(Glasgow), B.Sc., A.R.T.C., M.I.E.E., A.M.I.Mech.A.

Offer a series of Six Wednesday evening lectures entitled

AN INTRODUCTION TO SERVO-MECHANISMS

by K. B. REED, B.Sc.(Eng.), A.M.I.E.E.

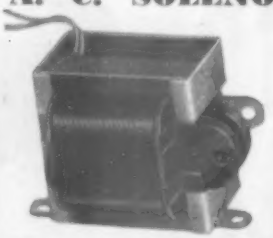
commencing on 2nd February from 7-9 p.m.

The lectures will include discussion and analysis of servo-elements and their application to closed loop systems. The conditions for stability of systems will be developed and methods of stabilising indicated. Practical demonstrations of various servos will be given.

FEE: £2 2 for the series.

ENROLMENT: By personal application from 9 a.m. to 8.30 p.m., or by postal application to the Secretary, Thomas Street, London, S.E.18.

A. C. SOLENOID TYPE SC.



Continuous 3 ozs. at ½"
Instantaneous to 39 ozs.

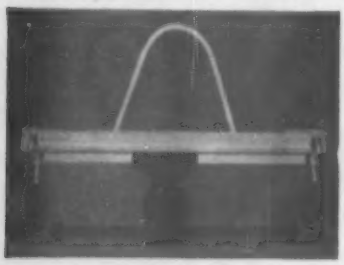
100% PRODUCTION INSPECTION

Larger Sizes Available
Also Transformers to 6 KVA 3 Phase.

R. A. WEBBER LTD.

18 FOREST ROAD, KINGSWOOD, BRISTOL. Phone : 74065

PARKER'S SHEET METAL FOLDING MACHINE



Heavy Vice Model. Capacity 18 gauge M.S.x2ft. wide. Loose Attachments for Radio Chassis Making Weight 22 lb. Price 50/-. Attachments 1/6 per ft. Carriage 4/-, with attachments 5/6.
Also **Parker's Square Type Drill Vice.** Machined table 7in. × 6in. × 4in. Jaws of Bright Steel. Admits stock of 4in. Complete with stand. Heavily constructed. Wt. 13½lb.
Price 37/6. Carriage 2/6

Machines guaranteed. Stamp for details.

A. B. PARKER WHEATCROFT WORKS, WELLINGTON STREET, BATLEY, YORKSHIRE. Tel.: Batley 426

THE WORLD'S GREATEST BOOKSHOP

FOYLES

FOR BOOKS

All new Books available on day of publication.
Secondhand and rare Books on every subject.
Stock of over three million volumes.

Foyles have depts. for Gramophone Records, Handicraft Materials, Stationery, Music, Magazine Subscriptions.

119-125 CHARING CROSS ROAD, LONDON, W.C.2
Gerrard 5660 (16 lines) ★ *Open 9-6 (Thurs. 9-7)*
Nearest Station: Tottenham Court Road

MAXI-Q REGD.

IMPROVED TWO WAVEBAND

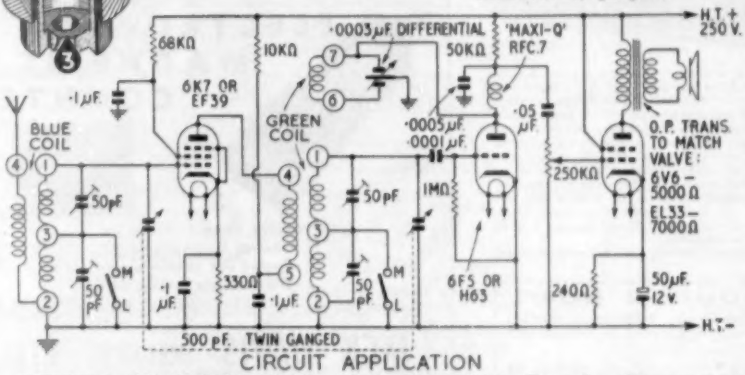
T.R.F. COILS

These Long and Medium waveband T.R.F. Coils are an improvement on our already well-known "C" Coils. If you wish to improve the performance of the "Midget Three Valve A.C. Mains Receiver" by S. W. Amos (*Wireless World*, February, 1950), we strongly recommend the use of these coils.

The following points are worth noting:

1. Wound on Polystyrene Colour Coded Formers—C2 R.F. Aerial Transformer, Colour Coded Blue—C3 Detector with Reaction, Colour Coded Green.
2. Litz windings on Long waveband.
3. Single 4 B.A. hole fixing.
4. Coverage: Long wave 800/2,000 metres. Medium wave 190/550 metres.
5. Windings are terminated to tinned copper spills which ensure ease of soldering.

Retail Price—9/- per pair.



CIRCUIT APPLICATION

Send 1/- in stamps for General Catalogue. Obtainable from all reputable stockists or in case of difficulty direct from works.

DENCO (CLACTON) LTD., 357/9 Old Road, Clacton-on-Sea, Essex

STOP PRESS: "Osram" "912" high quality amplifier chassis, 14/6. Front panel finished in bronze complete with control markings, 6/6. "Mullard" "Five-Ten" amplifier chassis, 14/6. Front Panel, 6/6.

WODEN TRANSFORMER CO. LTD

INDUSTRIAL ELECTRONICS

This Woden Transformer is typical of many supplied for Industrial Electronics and is for incorporation in a large R.F. Heater made by a well known manufacturer. Transformers in this field are individually and specially constructed to suit design of heater.

Price is an important factor and all Woden Transformers are built at the lowest cost, consistent with first-class workmanship and materials, to guarantee the utmost reliability in service.

WODEN TRANSFORMER CO. LTD.

MOXLEY RD., BILSTON, STAFFS. Telephone: Bilston 41959

sm/W.2097 a.

BUILD THIS RADIO FOR 49/6

Build this high quality portable radio in 45 mins. Exceptionally sensitive, twin-triode circuit using unique assembly system. Can be built by anyone. Size only 6½in. x 5in. x 3in. In handsome black crackle steel case, with beautiful black and gold dial panel (stations printed!). Covers all Medium and Long waves. Uses only one self-contained standard dry battery—running costs less than 1d. for 4hrs. Luminous on/off switch. **Ideal for Bedroom, Garden, Holidays, Christmas Present etc. Many unsolicited testimonials:—Mr. J.N., of Oxted, writes:** *" Yesterday evening between 10 p.m. and 10.30 p.m. I counted 32 separate stations! I am very pleased with the set, which is well worth the money."* **Mr. W.J.B., of Acton, writes:** *" Radio received today, I was surprised and very pleased with the performance. For such a small set reception is very clear. The tone is perfect and the stations just roll in."* **Mr. G.F.P., of Ipswich, writes:** *" I think it is a wonderful station getter, with lovely tone and ample volume on all. Its performance is almost unbelievable, and it gives me stations I've never been able to get on my large radio."* These testimonials and many others can be seen any time at address below. **Send today, Cheque or CWO for 22/- (includes 2/6 packing and post),** for Case, Handle, Dial Panel, Plans, Parts List, etc., **or 49/6** (post free) **for complete kit of parts.** C.O.D. 1/6 extra. *Overseas orders and enquiries welcomed.*

BRIGHTON RADIO CO. (Dept. W11), 49 Preston Street, Brighton, 1.

SEND THIS COUPON NOW!

To **Brighton Radio Co., 49 Preston Street, Brighton, 1, Sussex.** I enclose cheque/POs/Cash/MO. (mark which) for 22/- (or 49/6 for Full Kit). Please send to:—

NAME ..... [C.O.D. 1/6 extra]

ADDRESS .....

.....

Please print in block letters.

MAGNETIC RELAYS

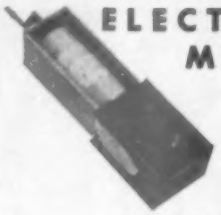
Built to specification

TYPES 3000 and 600

HIGH SPEED, also A.C. 6-400 volts

KEY SWITCHES. SEVERAL TYPES IN STOCK

ELECTRO-MAGNETIC COUNTER



MAJOR TYPE 6 × 1½ × 1½ ins.
for all D.C. voltages.
Tested and guaranteed.
17/6, Post and Packing, 9d.

JACK DAVIS (RELAYS) LTD.

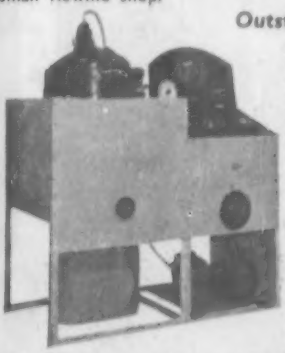
36 PERCY STREET · LONDON · W.1

MUSEUM 7960 LANGHAM 4021

IMPREGNATE your coils with ease

BLICKVAC

High Vacuum Impregnators meet the most stringent specifications and yet are easy to handle.
Full range of models available to meet the needs of the large-scale producer, the research laboratory or the small Rewind shop.



Outstanding Features :

- Ease in control.
- Ease in cleaning.
- Elimination of vibration.
- Unequalled flexibility and performance.
- Simple attachment of auxiliary autoclaves.
- Units available suitable for Varnish, Wax, Bitumen and Potting Resins.

Users include M.O.S., N.C.B., G.E.C., Pye, Marconi, Metro-Vick.

If your problem is COIL IMPREGNATION or Impregnating or casting with Potting Resins consult:

BLICKVAC ENGINEERING LTD.

Bede Trading Estate, Jarrow, Co. Durham. Jarrow 89/7155
96-100 Aldersgate Street, London, E.C.1. Monarch 6255/8

POLYTHENE

H. F. EQUIPMENT

(AMBYTHENE BRAND)

COIL FORMERS
CHOKES
STAND-OFFS
FEED-THROUGHS

Send for particulars and Samples

AMPLEX APPLIANCES (KENT) LTD.

19 DARTMOUTH ROAD, HAYES, BROMLEY, KENT

(RAVensbourne 5531)

All export enquiries to

ANTEX LTD., 3 TOWER HILL, LONDON, E.C.3

PROGRESS . . .

The Result of Splendid Effort!

P.V.C. AND POLYTHENE SLEEVINGS INSULATED WIRES AND FLEXIBLES

British enterprise, energy and ingenuity produced the Jet Engine . . . There is no limit to British achievements . . . There is also no end to the insulating Sleevings which we produce for many industrial applications.

A.I.D. Approved

PLASTICABLE LIMITED

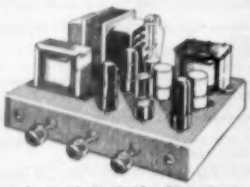
HAWLEY LANE, FARNBOROUGH, HANTS

Phone: Farnborough, Hants 85

Quality Equipment Designers Ltd.

75 GRAND PARADE, HARRINGAY
LONDON, N.4. Phone: STA. 3712

FIRST OF THEIR CLASS—AND STILL FIRST CLASS



CONSTRUCT YOUR OWN AMPLIFIER

This High Fidelity 8-10 watt amplifier has been specifically designed for use with Gram., Microphone and Radio. Valve line up:—6SL7, 6SN7 phase splitter, 2 6V6G (matched) outputs, 5Z4 rectifier. Negative feedback, comprehensive tone control using separate Bass and Treble control giving 16db boost in treble and bass, and 16db attenuation in treble, 5db attenuation in bass relative to 1 Kc/s. The Output transformer supplied is tapped for either 3 ohm or 15 ohm speakers.

Incorporated is a feeder unit input socket. Equalizing networks are available for the Collaro Studio 'C' and 'P' heads, etc. Circuit diagram, etc., available separately at 1/-. For operation on A.C. Mains 200/250 volts.

All components supplied are guaranteed for one year. Valves 3 months.

To those wishing to purchase this High Fidelity Amplifier ready-built and tested, we can supply same at £11/12/6 plus 4/- for Pkg., Carr. and Ins. (Please state whether for use with 3 ohm or 15 ohm speaker.)

Complete Kit £10-7-6

PLUS 3/- Pkg., Carr. & Ins.

Acos, etc. Chassis dimensions:—12 x 8 x 2½in.

THE NEW LOOK T.R.F. RECEIVER

Build this superb radio at a total cost of only

Complete Kit £5-15-0

plus 2/6 Pkg. and Carr

This is a 3 valve T.R.F. plus Metal Rectifiers; with a valve line up as follows:—6K7 (HF); 6J7 (DET); 6V6 (OUTPUT). Wave band coverage is 180/550 metres on Medium wave, and 800/2000 metres on Long wave.

The Walnut cabinet is the latest design and is outstanding in appearance.

Assembly instructions 1/- (post free), include point-to-point wiring, chassis layout, etc. also stock list of priced components (which may be purchased separately). This receiver may be purchased completely built and ready for use at total cost of £6/15/- plus 3/6 Pkg. and Carr. All components are guaranteed for one year. Valves 3 months.

FREE TECHNICAL ADVICE GIVEN TO ALL OUR CUSTOMERS

MAINS NOISE SUPPRESSOR UNIT

A simple and effective method of cutting out all mains noises. The Kit consists of 2 specially designed chokes together with 3 condensers. The unit can be assembled in existing receivers or separately if so desired.

4/11 COMPLETE WITH CIRCUIT DIAGRAM Plus 6d. post, etc.

W. B. STENTORIAN HI-FI LOUDSPEAKERS

HF 610 6in. 3 or 15 ohms imp.	50/6
HF 810 8in. tapped 3-4, 7.5 and 15 ohms imp.	65/6
HF 912 9in. 3 or 15 ohms imp.	67/-
HF 1012 10in. tapped 3-4, 7.5 and 15 ohms imp.	77/6

All the above plus 2/6 packing, carriage, insurance

ALUMINIUM CHASSIS WITH REINFORCED CORNERS

6 x 4 x 2½	4/9	8 x 6 x 2½	6/9
10 x 7 x 2½	7/6	12 x 8 x 3in.	9/9
14 x 8 x 2½	10/9	16 x 9 x 2½	13/6
12 x 8 x 2½	8/-	14 x 3 x 2½	6/6
12 x 8 x 3½	7/-	16 x 6 x 2½	10/-

Add 1/- to whichever size required to cover cost of packing and postage.

WALNUT POLISHED SPEAKER BAFFLETTES

6 in. ..... 18/6 each. 8 in. ..... 20/6 each
10 in. ..... 24/6 each. Pkg. & Post 2/- each

BALL BEARING SLIDERS

BRAND NEW AT A THIRD BELOW NORMAL PRICE. Specially designed to give smooth silent movement with complete rigidity in any position. Cadmium plated steel captive ball carriage with brass spring. These sliders are suitable for extending Radiogram Motor Boards, Tape Decks, Cabinet drawers, etc. LENGTH 13in.—RUBBER EXTENDS 9in.

10/- pair. POST FREE

We carry large stocks of Resistors, Condensers, and all Radio, T.V. and Electronic Components. Let us quote you for your specific requirements (SEND 2½d. STAMP FOR CATALOGUE).

TERMS OF BUSINESS:—Cash with order or C.O.D. All orders for small items totalling over £2 post free unless otherwise stated.

To personal shoppers wishing to visit our premises ALIGHT AT HARRINGAY ARENA. OPEN FROM 9 a.m.-6 p.m. MONDAYS-SATURDAYS (EARLY CLOSING WEDNESDAYS).

"You can rely on us"

We specialise *ONLY* in Radio Components

An example of a few of our stock lines :—

RESISTORS

Erie type 8 and 9. 6d. each.

Morganite Type 'T' ½ w., 6d. ea.

Morganite Type 'R' 1 w., 8d. ea.

Complete range, 10 ohms to 10 mg. High Stability, ½ w. 2% (very accurate), 1/6 ea. Range 100 ohms to 2 mg.

Wirewound 5 to 7 watt, 2/3. 10 watt, 3/9.

New green vitreous type now available 10 watt max. rating. Any value ±5k up to 100k. Minimum quantity 1 dozen of a value 25/-

CATALOGUE No. 12
70 page, 250 illustrations. Price 1/-.

LOUDSPEAKERS

WHARFEDALE 8in. Bronze, £3/10/10.
Super 8/CS/AL, £6/13/3.
Bronze 10in., £4/12/6.
Golden 10in. unit, £7/13/3.
GOODMANS Orlin, £9/15/-.
W.B. HF.810, £3/0/6.
HF.1012, tapped for 3, 7.5 and 15 ohms, £3/17/6.
HF.1214, £9/15/6.
All from stock.

INSTRUMENTS

AVO'S IN STOCK
D.C. Minor, £5/5/-.
Universal Minor, £10/10/-
Model 40, £19/10/-
Model 7, £19/10/-.
Model 8, £23/10/-.
Taylor Montrose, 50/- and other Taylor instruments.

Instruments can be supplied on H.P. Terms. Please ask for details.

BOOKS

"W.W." Valve Manual, 4th Edit. 3/6.

Amplifier manual No. 3 (containing details of Mullard amplifier), 3/6.

Radio Gadgets, 3/6.

T.V. Faults, 5/-.

Oscilloscope Book, 5/-.

Audio Amp. Handbook by Crowhurst, 3/6.

Personal Receivers, 3/6.
Amplifier Circuits, 3/6.

T.V. Practice, 5/-.

Comprehensive Book of Valve Equivalent and Service Types, 5/-

MISCELLANEOUS

Charging Transformers 2, 6 and 12 v. 2 amp., 19/6. 2, 6, 12 v. 4 amp., and 24 v. 2 amp., 22/6.

"PANL" Black Crackle Paint (no stoving), 3/- tin.

Transfers (best quality), No. 1 set amplifiers and receivers 3/6. No. 2 Test Equipment, 3/6.

OSRAM 912
Parts in stock incl. G.E.C. 8in. metal cone spkr., £8/15/-.

Please add sufficient post/packing, goods C.W.O. or C.O.D. Companies, etc. Monthly accounts.

RADIO SERVICING COMPANY

82, SOUTH EALING ROAD, LONDON, W.5. Telephone: EAL. 5737

AUDIO OSCILLATOR UNIT

This compact, pre-calibrated unit is eminently suitable for incorporation in any equipment requiring an accurate source of frequency covering the range 20~ to 20 kc/s. Its power requirements are small, and it is supplied complete with drilling template and all accessories required for fitting. When fitted to a high-fidelity amplifier it enables rapid checks of performance to be carried out.

Price: £6-0-0
(Postage & packing 3/6)

SEND FOR FULL DETAILS OF THIS AND OTHER INSTRUMENTS

EASY PAYMENT TERMS AVAILABLE

HOMELAB INSTRUMENTS LIMITED,
615-617, High Road, London, E.10
Phone: LEY 5651

REPLACEMENT RADIO/RADIOGRAM CHASSIS

"THE CLEVELAND FIVE"

A.C. Mains 200/250 v. Valve line-up: U78X/79, W727, DH77, N727. Standard L.M.S. Wave-range with Gram position. 4 controls: (1) Off/On/Tone. (2) Volume. (3) Gram L.M.S. (4) Tuning. Dial size 11in. x 4½in. Chassis size: 12in. x 7in. x 7½in. high.
Supplied for vertical or horizontal mounting.

All L.M.S. W/B coverage, Gram position. S/Het circuit. A.C. mains 200/250 v. 4 controls; 5 valves; E.C.H.42, EF41, EL41, EBL41, EZ40. Large 3 colour, edge-lit scale.
R/I CHASSIS. Scale size 10in. x 4½in. Chassis 13½in. x 6in. x 2½in. (R/I chassis supplied for vertical or horizontal mounting).
ESCUTCHEON. Bronze metal, with 4 fixing holes to suit R/I series chassis.
R/I CHASSIS (horiz. only). Scale 8in. sq. Chassis 11in. x 7in. x 2½in.

Send for detailed list of chassis, also cabinets, tape recording equipment, etc. Trade only supplied.

Send for our current monthly bulletin—always contain something new and interesting.

V.E.S. WHOLESALE SERVICES Ltd
Dept. (W.W.), 11, Gunnersbury Lane, Acton, W.3. Tel.: ACOrn 5027

BELCLERE

MINIATURE

INPUT, OUTPUT AND INTERSTAGE TRANSFORMERS

We specialise in the manufacture of coupling transformers to customers' requirements. An illustrated brochure describing the range of transformers we manufacture will gladly be sent on request.

Illustrated above is a standard input transformer type "E" size 1in. x ⅞in. x ⅝in. overall, available with varnish dip finish, encapsulated block form, or in mu-metal screening can.

Quick delivery—low prices—maximum efficiency.

JOHN BELL & CROYDEN, 117 HIGH STREET, OXFORD
Telephone: 47072. ● Cables: Belclere, Oxford.

TRANSFORMERS
COILS
CHOKES

LARGE OR SMALL QUANTITIES
TRADE ENQUIRIES WELCOMED

SPECIALISTS IN

FINE WIRE WINDINGS

MINIATURE TRANSFORMERS, PICK-UP, CLOCK AND INSTRUMENT COILS, ETC.
VACUUM IMPREGNATION TO APPROVED STANDARDS

ELECTRO-WINDS LTD.
CONTRACTORS TO G.P.O., M.O.S., I.E.S., ETC.
123-5-7 PARCHMORE ROAD, THORNTON HEATH, SURREY
LIVINGSTONE 2261 EST. 1933

QUARTZ CRYSTAL UNITS

Press mounted or high vacuum plated

Modern Equipment

Quick Delivery

NORWEGIAN MINING LTD., A/S.
OSLO, NORWAY.
Cable Address: "Normining," Oslo.

H. WHITAKER G3SJ.,
10, YORKSHIRE STREET, BURNLEY

Phone: BURNLEY 4014

Manufacturers of precision Quartz Crystals in a wide variety of bases covering the complete range 50 Kc. to 15 Mc. in fundamental frequencies. All are made to extremely fine tolerances, and frequency adjustment can be given up to .005%. Plated electrodes of gold, silver or aluminium with wires in spot welded contacts are available. Quotations can be given for any type of cut or mode of oscillation including a complete range for filter circuits with zero temperature co-efficient over a sensibly wide temperature range. Our new works is equipped with up-to-the-minute production technique methods. X-ray orientation ensuring accuracy of all cuts. Artificial aging by etching and plating by evaporation under vacuum ensure long term stability of the final calibration. Early delivery can be given of most types. Our regrind service is still available and in some cases we are prepared to quote for lowering the frequency of your existing crystals.

SPECIAL OFFER:

200 kc. DT cut, zero temperature co-efficient over the range—20° centigrade to +50° centigrade. Frequency adjustment .005% or better. Mode: Face shear. Silver-plated electrodes, wire mounted. Basing ⅛in. pin spaced. Other bases to order, 21 each.

PRATTS RADIO

1070 Harrow Road, London, N.W.10
(Nr. Scrubs Lane) Tel. LADbroke 1734

MODEL AC10E £10/7/6.

AMPLIFIERS

College general-purpose units. **MODEL AC10E**, 4 valve, 10 watts. Reg. feedback, **£10/7/6. MODEL AC15E**, 6 valve, 14-15 watt P/P output. Feedback over 2 stages, **£14/14/-. MODEL AC25E**, 25 watts P/P output. Feedback over 3 stages, **£19/15/-. MODEL U16E**, for D.C./A.C. mains, 6 valve, P/P output. Feedback over 3 stages, **£12/19/6.** All are **COMPLETE WITH CASES** and chrome handles.

THEY HAVE A SEPARATE MICROPHONE STAGE and gram. inputs allowing **MIXING** of speech and music. Outputs match 3, 9, 15 ohm speakers. **MODEL QGC**, 6-valve unit with Bass and Treble controls. P/P output of 9 watts. This amplifier incorporates an 18 section O/Transformer. Variable feedback from zero to 26 db. Output impedances 2.5 to 250 ohms. Complete chassis, **£14/14/-.** Complete range of accessories available, also tape recorders, amplifiers, etc. Stamp for list. All amplifiers ready for use and carriage paid. Terms available.

MONEY BACK GUARANTEE
GOODS OF QUALITY
PROMPT DESPATCH

BARTON'S (Radio)

TERMS OF BUSINESS: Cash with order (or C.O.D. Post Items only); all orders for small items totalling over £2 post free unless otherwise stated.

OFFICE: 34, MONTPELIER RISE, LONDON, N.W.11. Telephone: MEAdway 1736

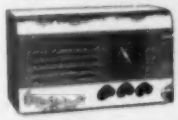
MAIL ORDER, WORKS & DESPATCH DEPT.
44, TOTTENHAM STREET, LONDON, W.1. Telephone: LANgham 1151

Open 9 a.m. to 6 p.m. Daily, Saturdays 1 p.m.

We are pleased to inform our customers both old and new that our Mail Order Dept. has been transferred to more spacious premises at 44, Tottenham St., London, W.1 (first turning left from Goodge Street Underground). This move was made necessary by the ever-increasing demand for our goods. Due to the improved facilities at our new premises we can once again assure customers of immediate despatch.

PERSONAL CALLERS WELCOMED

BUILD YOUR OWN RADIO!



We can supply all the parts (including valves, 8in. moving coil speaker, cabinet, chassis and everything down to the last nut and bolt) to enable YOU to build a professional-looking radio. The chassis is punched and drilled ready to mount the components. There is a choice of any of three attractive cabinets 12in. long, 8in. wide by 6in. high, as follows: either ivory or brown bakelite, or wooden, finished in walnut. Complete and easy-to-follow point-to-point circuit wiring diagrams supplied.

MODEL 1 T.R.F. RECEIVER

This is a 3-valve plus metal rectifier T.R.F. receiver with a valve line-up as follows: 6K7 (HF), 6J7 (Det.) and 6V6 (Output). The dial is illuminated. Coverage is for the Medium and Long Wave Bands. Model 1—200/250 volts A.C. Mains operation. Model 3—200/250 volts A.C./D.C. mains operation.

Plus 2/6 Packing Carriage, Insur. **£5 . 10 . 0**

MODEL 2 SUPERHET RECEIVER

This is a powerful midget 4-valve plus metal rectifier Superhet Receiver with a valve line-up as follows: 6K8, 6K7, 6Q7, 6V6. The dial is illuminated and coverage is for the Short Wave bands between 16-50 metres, the Medium Wave bands between 190-400 metres, and the Long Wave bands between 1,000-2,000 metres. Operates on 200/250 volts A.C. mains.

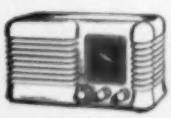
Plus 2/6 Packing Carriage and Insur **£7 . 19 . 6**

Instruction Booklet and priced Parts List available separately at 1/-. This money will be refunded if circuit diagram is returned as NEW within 7 days.

THE MODELS 1 & 3 T.R.F. RECEIVERS

can be supplied ready built at £6/15/6 plus 3/6 P. & C

THE NEW T.R.F. . . . MODEL 1 PLUS. . . . THE RECEIVER WITH THE SENSATIONAL PERFORMANCE!!



This is a completely new design 4-VALVE, 2-Waveband T.R.F. Receiver, incorporating the latest type MINIATURE HIGH GAIN VALVES, and the most modern design HIGH "Q" IRON CORED COILS, ensuring greatly increased sensitivity and selectivity over the whole of the Medium Waveband, and providing outstanding performance on the Long Waveband. 4 Valves—6BJ6 R.F. Amplifier. 6BH6 Anode Bend Det. 6AQ5 Output. 6X4 Rectifier. For operation on 200/250 volt A.C. Mains. The Completed Receiver is housed in the attractive cabinet illustrated. Choice of either the Ivory or Brown Bakelite, or Wood, (Walnut Finished).

All the parts to build this Receiver can be supplied at **£6 . 19 . 6** Plus 2/6 Packing Carriage and Insur.

Can also be supplied ready built at £8/5/-, plus 3/6 p. & c.

INSTRUCTION BOOKLET and PRICED PARTS LIST available separately at 1/-. This money will be refunded if circuit diagram is returned as new within 7 days.

ALL COMPONENTS SUPPLIED ARE GUARANTEED FOR 12 MONTHS

MAINS NOISE SUPPRESSOR KIT

Consisting of 2 specially designed chokes and 3 condensers. Extremely effective, cuts out all mains noise. Can be assembled in existing receiver or separately as desired. Complete with circuit diagram. 4/11 plus 1/- p.c.

BATTERY CHARGER KIT

Incorporates metal rectifier. Transformer is suitable for A.C. mains 200/250 volts. Charges either 12, 6 or 2 volt accumulator at 1 amp. Complete with circuit diagram. Price 19/11 plus 1/6 post and packing.

PLEASE NOTE NEW ADDRESS

The specially selected and carefully matched components used in Barton's Radio Designs are obtainable only from Barton's (Radio) at their new address at 44, Tottenham Street, London, W.1.

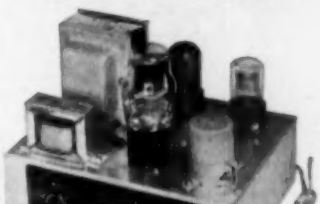
WE HAVE NO AGENTS

4 watt AMPLIFIER KIT

This is a 3-valve 3-stage Amplifier for use with Gramophone, Microphone or Radio. Valve line-up is as follows: 6SL7, 6V6, 5Z4. Negative feed-back. Tone control. Voltage-adjustment panel incorporated. 4 watts output. For operation on A.C. Mains 200/250 volts.

The complete Kit, which includes every item, down to the last nut and bolt, drilled and punched chassis, and comprehensive point-to-point wiring circuit diagram.

ALL COMPONENTS SUPPLIED ARE GUARANTEED FOR 12 MONTHS



PRICE

£4 . 5 . 0 Plus 2/6 PACKING CARRIAGE & INSUR.

The Output Transformer supplied is for use with a loud-speaker of 3 ohms impedance, and we would suggest that the output of the completed amplifier justifies the use of one of the latest W.B. H.F. Speakers which can be supplied as follows: 8in., 60/6; 9in., 67/-; 10in., 73/6. All plus 2/6 pkg., carr., ins.

Circuit Diagram and parts list available separately at 1/-.

To those who require this Amplifier ready built we can supply it at £5/1/-, plus 3/6 pkg., carr., ins.

RADIO TUNER UNIT

A new T.R.F. Tuner Unit designed for High Quality Local Station Reception, at Low Cost. Incorporates 2 Valves—6K7 and 6J7. Volume, Tuning and Wavechange Controls. Medium and Long Wave coverage. Dimensions: L. 8in. H.5¼in. D. 4¼in.

Power Requirements: 6.3 volts at 0.6 amps. 250-300 volts 15 mA. (This supply is already available in the above illustrated Amplifier). All the parts to build this Tuner Unit can be supplied at

£2 . 15 . 0 p'us 2/6 Packing & Carr.

Complete with easy-to-follow Circuit diagram and Parts List.

Circuit diagram and Parts List available separately at 1/-

This Unit can also be supplied ready built at £3/15/-, plus 2/6 Packing and Carr.

WAX TUBULAR CONDENSERS WITH WIRE ENDS

.001 mfd. 350 v. 5d. each or 4/6 doz.
.002 mfd. 400 v. 5d. each or 4/6 doz.
.002 mfd. 1,000 v. 9d. each.
.005 mfd. 600 v. 9d. each.
.01 mfd. 500 v. 5d. each or 4/6 doz.
.02 mfd. 1,000 v. 7d. each.
.05 mfd. 500 v. 6d. each or 4/6 doz.
.05 mfd. 350 v. 9d. each.
.1 mfd. 500 v. 6d. each.
.25 mfd. 350 v. 5d. each or 4/6 doz.
.3 mfd. 500 v. 5d. each or 4/6 doz.

VARIABLE CONDENSERS

3 gang .0005 mfd. ..... 5/6 ea.
2 gang .00035 mfd. ..... 5/9 ea.
2 gang .0005 with feet and trimmers ..... 7/6 ea.
2 gang Midget with dust cover .00035 mfd. with trimmers ... 6/6 ea.

TINNED COPPER WIRE—All 4 oz. Reels.

16 S.W.G.	3/-
18 S.W.G.	2/2
20 S.W.G.	2/4
22 S.W.G.	2/6
24 S.W.G.	2/8
26 S.W.G.	2/10

ENAMELLED COPPER WIRE—All 4 oz. Reels.

S.W.G.	Price	S.W.G.	Price
16	1/11	30	2/1
18	2/1	36	3/3
20	2/3	34	3/6
22	2/5	36	3/7
24	2/7	38	3/11
26	2/9	40	4/2
28	2/11		

CHASSIS

Aluminium Undrilled with Reinforced Corners. Available in the following sizes.

6in. × 4in. × 2½in. ..... 4/6 ea.
8in. × 6in. × 2½in. ..... 6/3 ea.
10in. × 7in. × 2½in. ..... 7/3 ea.
12in. × 8in. × 2½in. ..... 8/6 ea.
14in. × 8in. × 2½in. ..... 9/6 ea.
16in. × 9in. × 2½in. ..... 12/- ea.

All are four sided—ideal for radio receivers—amplifiers—powerpacks etc.

PERSPEX IMPLOSION GUARDS

Incorporating countersunk and filter. 12in. type 11/6 ea. 16in. type 14/6 ea.

POCKET TEST METER

Ex. Govt. volt meter, two ranges 0-15 v.; 0-250 v. D.C. complete in case 17/6 each.

NYLON CORD

25 yd. reels Nylon drive cord on wooden reel 2/9 each.

WE INVITE YOU TO BUILD THIS PORTABLE FOR ONLY £5 gns.

Full details, circuit diagram, point to point wiring instructions, and complete list of components. Available 2/- ea. Case can be supplied separately. Available in the following attractive colours: ● Lizard Grey; ● Blue; ● Maroon; ● Brown. Dial, 1/3 each. Chassis, 3/-.

VIBRATORS ETC.

Vibrator unit for 6 v. operation 14/6 ea. Post 1/6. 6 v. and 12 v. Vibrators, 4 pin UX types, 6/6 each.

ALPHA SPECIAL PURPOSE VALVES

2X2	5/-	807	7/6	956	3/6	VR65	3/9
1A5GT	6/6	9001	5/6	CV173	10/-	VR65A	3/6
1LD5	6/9	9002	5/6	CV286	7/6	VR66	3/9
5Z3	8/6	9003	5/6	E1148	2/-	VR91	6/-
6B4	6/-	9004	5/6	VR53	6/6	VR91(SYL)	8/-
6G6G	6/6	9006	6/-	VR54	2/-	VR92	2/-
6S7	7/6	954	2/-	VR55	7/6	VR105/30	9/-
VR119	6/-	VR136	7/-	VR56	6/-	VR116	4/-
VT52	8/-	TT11	6/-	VR137	6/3	VR150/30	9/-
VU111	3/6	VU120A	2/-	VU39	8/6	VU64	8/6
77	8/-	955	4/9	VR40	8/-	Full List Available.	
836	15/-	866A	10/-	6SA7	8/6		

HEADPHONES—MICROPHONES, Etc.

EX-GOVERNMENT HEADPHONES BY S. G. BROWN, etc.

CLR Low resistance type 120 ohms ..... 7/6 pr.
CHR High resistance type 4,000 ohms ... 11/- pr.
DHR a super phone ..... 13/6 pr.
American phones by Trimm Mfg. Co. of Chicago, U.S.A., 1,200 ohms, each earpiece ..... 13/9 pr.
Headbands, wide type ..... 1/9 ea.
Throat microphones, American surplus. Complete with strap, lead and plug type T30B ..... 4/- set
"Regent" Hand Microphone. Crystal insert, nickel chrome plated head, complete with lead and jack plug, listed at 2 Gns. Our price ..... 21/- ea.
Throat Microphones, type Za.21095. 2 units per box ..... 1/9 per box

HEATER TRANSFORMERS

230 v. Input	2 volt .5 amp.	4/6
230 v. Input	2 volt 3.0 amp.	7/9
230 v. Input	4 volt 1.5 amp.	8/-
230 v. Input	4 volt 3.0 amp.	10/-
230 v. Input	5 volt 2.0 amp.	10/-
230 v. Input	6.3 volt .5 amp.	5/-
230 v. Input	6.3 volt 1.5 amp.	6/-
230 v. Input	6.3 volt 3.0 amp.	9/-
230 v. Input	12 volt .75 amp.	5/-

PRESET CONTROLS (CARBON)

50 KΩ; ½ megΩ; 1 megΩ; 2 megΩ; 1/9 each.

HUNTS CONDENSERS

Type W99, 200 pf. 350 V. } ..... 7d. ea.
" W99, .005 mfd. 150 V. }
" W48, .1 mfd. 400 V. ..... 1/- ea.
" L44, .1 mfd. 500 V. ..... 9d. ea.

RESISTORS 1 WATT

2.2 KΩ; 470 Ω; 7.5 KΩ; 22 Ω; 150 Ω; 5.6 ΩK; 390 Ω; 150 KΩ; ½ megΩ; 39 Ω; 1.5 megΩ; 56 KΩ; all 4d. each.

BAKELITE CASED CONDENSERS

.1 mfd. 1000 V.; .03 mfd. 4 kV.; .01 mfd. 4 kV.; .03 mfd. 500 V.; .001 mfd. 4 kV. All 1/6 each.

NITROGOL CONDENSERS

12 mfd. 350 V. ..... 5/6 ea.

OSMOR COIL PACKS

Type H.O. 48/- each. Type LM 49/- each.
Type T.B. 50/- each. Type TRF 49/- each.

SPRAGUE CONDENSERS

.05 mfd. 500 V.; .01 mfd. 1000 V.; .1 mfd. 350 V.; .02 mfd. 750 V. All 9/- doz.

RESISTORS—Brand new. A good selection from 10Ω to 15 meg. Ω. All popular sizes. 29/- per 100.

MAINS TRANSFORMERS

Input 200/250 volts. Output 325-0-325 v. 20 mA 6.3 v. 3a. 12/- ea.
20 amp 2 pole Diamond switch, 4/6.

LOUDSPEAKER UNITS

Rola 5in. speaker with trans.. 16/- ea.
Plessey 6½in. lightweight unit 16/6 ea.
Rola 6½in. standard type ..... 17/6 ea.
Lostrens 6½in. with trans..... 18/- ea.
Truvox 6½in. wafer type ..... 20/- ea.
Plessey 8in. lightweight unit.. 17/6 ea.
R. & A. 8in. standard type .. 17/6 ea.
Plessey 10in. unit ..... 19/6 ea.
Elac 10in. unit ..... 22/6 ea.
R. & A. 10in. unit ..... 22/6 ea.
Goodmans 10in. unit with trans. 26/6 ea.
Elliptical 6in. × 4in. unit .... 18/6 ea.
Mains Energised 5in. unit 1000 Ω ..... 21/- ea.
Mains Energised 6½in. unit 600 Ω ..... 17/6 ea.

CRYSTAL DIODES

Plastic case, wire ends, 2 for 2/1.

CONDENSERS

Waxed cartons with flying leads, 4 mfd. 500 V. 1/6 ea. 4 × 4 mfd. 500 V. 3/4 each.

IRON ELEMENTS

Standard adaptable type 230 V. 450 V. ..... 1/6 ea.
Morphy Richards replacement type ..... 3/6 ea.
H.M.V. replacement type .... 3/- ea.

PLIERS

With side cutters ..... 4/6 pr.

DOUBLE TRIMMERS

250/250 pf.; 100/100; 100/50. All 6d. ea.

YAXLEY SWITCHES

1 pole 9 way ..... 1/6 ea.
4 pole 2 way ..... 1/9 ea.
4 pole 3 way ..... 1/6 ea.
2 pole 3 way 3 break ..... 1/6 ea.

OCTAL PLUG AND SOCKET

(Screened) ..... 1/- ea.

HIGH VOLTAGE E.H.T. CONDENSERS

.002 mfd. 12 kV. ..... 7/6 ea.
.001 mfd. 6 kV. ..... 5/- ea.
.500 pf. 10 kV. ..... 5/- ea.

CONNOISSEUR PICK-UP

Standard model, magnetic type, complete with matching transformer. Listed at £4/10/5. Our Price £3/6.

Box of 4 BA. nuts and shakeproof washers and bolts mixed, countersunk and round head, over 100 items, 1/- box.

2 meg. Amplion vol. controls, double pole switch, 2/6 each.

1 meg. Erie vol. controls, double pole switch, 2/6 each.

100 KΩ; ½ megΩ; ¼ megΩ; single pole switch 2/- each.

RECORDING TAPE

1,200 feet tape on Cyldon reel. (Brown plastic type.) 13/6 reel.

INTERNATIONAL OCTAL VALVE HOLDERS

Paxolin 4d. each. Amphenol 6d. each. Ceramic 1/- each.

WIRE WOUND RESISTORS

Available in the following values:—
25Ω, 50Ω, 100Ω, 150Ω, 200Ω, 250Ω, 350Ω, 500Ω, 1,000Ω, 1,500Ω, 2,000Ω, 2,500Ω, 3,500Ω, 5,000Ω, 6,800Ω, 10,000Ω. Tolerance plus or minus 10 per cent. Ratings 5 watt, 1/- ea.; 10 watt, 1/3 ea.; 15 watt, 1/9 ea.

FILAMENT TRANSFORMERS

Primary 200/250 v. Secondary 6.3 v. 1.5 amps, tapped at 4 v. and 2 v., 7/6 ea.
Mallory .1 mfd. 600 v. condensers, 1/- ea.
Pentode Output Transformer, 2/9 ea.

PORTABLE RECORDING OR PROJECTOR CASES

Rexine covered. (Ready for carrying 13in. x 9½in. x 12in.). Internal dimensions, 14in. long, 11½in. deep, 5½in. front height, 6½in. rear height. Weight 6½lb. Price 12/6 each.
Postage and Packing 2/-.

MAINS DROPPERS

Dubilier type BY71228, 1,350Ω with 5 tags, 2/6 ea.
945Ω Dropper with 5 tags, 2/6 ea.
Vibrator clips, 4d. ea.

POCKET TEST METER. Ex-Govt. volt meter, two ranges, 0-15 volts, 0-250 volts, D.C., 17/6 each.

TELEVISION PRE-AMPLIFIER. by Plessey, complete with valve (EF42), a small compact modern unit for London frequency. Price 13/6.

"COMPACT" TELEVISION AERIAL for indoor use London frequency, supplied complete with universal mounting backplate in neutral brown finish. Complete with full instructions. Cat. No. CD4. Original price, 50/-. Our price 12/6 ea.

METAL RECTIFIERS FOR CHARGERS

12 v. ½ a., 1/6; 12 v. 1 a., 4/9; 2 v. 1 a., 3/-; 12 v. 2 a., 10/6; 12 v. 3 a., 13/-; 12 v. 5 a., 18/6.

MOULDED MICA CONDENSERS

All wire ends. .0001, .0003, .0004, .0025, .01, .031, .035, .00027, .0003, .00035, .005, 4/6 doz.

BULGIN PORCELAIN STAND-OFF INSULATOR

3-hole fixing, wingnut type, 1/- each.

METAL CASE—AMPLIFIER OR BATTERY CHARGER CABINET. Finished brown crackle. Removable base or chassis. Vent holes. Supplied with bakelite side panel. Size 9½in. x 6½in. x 7½in. Price 8/6 ea.

CONDENSERS

The following is a selection of our stocks of manufacturers' surplus condensers, all by well known makers.

ALUMINIUM CAN TYPES, CLIP FIXING

8 × 8 mfd. 450 v.	4/- ea.
8 × 16 mfd. 450 v.	4/- ea.
8 × 24 mfd. 350 v.	4/- ea.
8 × 32 mfd. 475 v.	5/9 ea.
12 × 4 mfd. 450 v.	2/- ea.
16 mfd. 450 v.	2/- ea.
16 × 8 mfd. 350 v.	4/- ea.
16 × 16 mfd. 350 v.	4/- ea.
16 × 16 × 8 mfd. 350 v.	5/6 ea.
20 × 20 mfd. 500 v.	4/9 ea.
24 mfd. 450 v.	2/9 ea.
24 × 16 mfd. 350 v.	4/6 ea.
32 mfd. 450 v.	3/- ea.
32 × 8 mfd. 350 v.	4/6 ea.
32 × 16 mfd. 350 v.	4/6 ea.
32 × 32 mfd. 450 v.	6/11 ea.
32 × 32 × 8 mfd. 350 v.	5/6 ea.
32 × 32 mfd. 350 v. 25 mfd. 25 v.	5/9 ea.
40 mfd. 450 v.	2/9 ea.
64 mfd. 350 v.	3/- ea.

B.R. RANGE

B.R.850, 8 mfd. 500 v.	2/9 ea.
B.R.1650, 16 mfd. 500 v.	3/3 ea.
B.R. 2050, 20 mfd. 500 v.	3/6 ea.
8 × 8 mfd. 500 v.	4/- ea.
B.R.501, 50 mfd. 12 v.	1/9 ea.
16 × 16 mfd. 500 v.	4/- ea.
16 × 8 mfd. 500 v.	3/9 ea.

MIDGET METAL TYPES

2 mfd. 350 v.	1/9 ea.
8 mfd. 350 v.	1/1 ea.
8 × 8 mfd. 350 v.	3/- ea.
8 × 8 mfd. 450 v.	4/- ea.
16 mfd. 350 v.	2/9 ea.
16 × 8 mfd. 450 v.	4/- ea.
16 × 16 mfd. 450 v.	4/6 ea.
16 × 24 mfd. 350 v.	4/9 ea.
24 mfd. 350 v.	2/9 ea.
32 mfd. 350 v.	1/9 ea.
32 × 32 mfd. 350 v.	4/9 ea.
250 mfd. 12 v.	1/9 ea.

WIRE ENDED TYPES

8 mfd. 450 v. cardboard covered	1/11 ea.
30 mfd. 450 v.	3/9 ea.

HIAC CONDENSERS

Tag ended metal type

12 mfd. 50 v.	1/- ea.
25 mfd. 25 v.	1/3 ea.
50 mfd. 12 v.	1/6 ea.
50 mfd. 50 v.	2/6 ea.
100 mfd. 12 v.	1/9 ea.
100 mfd. 25 v.	1/9 ea.

WIRE ENDED TYPES CARDBOARD COVERED

25 mfd. 25 v.	1/9 ea.
50 mfd. 12 v.	1/9 ea.
50 mfd. 50 v.	3/9 ea.

TERMS : Cash with order or C.O.D. Postage to be added to orders as follows : 9d. up to 10/-; 1/- up to 20/-; 1/6 up to 40/-; 2/- up to £5. MAIL ORDER ONLY. Send 6d. in stamps for illustrated Catalogue.

ALPHA RADIO SUPPLY CO.
5/6 VINCES CHAMBERS, VICTORIA SQUARE, LEEDS 1.

WHEN ORDERING PLEASE QUOTE "DEPT. W.W."

Introducing The Stern's "Fidelity" Tape Recorder

!! A NEW DESIGN OF OUTSTANDING QUALITY !!

- WILL PLAY THE NEW PRE-RECORDED TAPES.
- WILL TAKE ALL STANDARD TAPES UP TO 1,200ft.
- WILL PROVIDE 2 HOURS PLAYING AT 3¾in. or 1 hour at 7½in. per second.
- INCORPORATES AN ELLIPTICAL P.M. SPEAKER 8in. × 5in., with EXTENDED FREQUENCY RANGE.

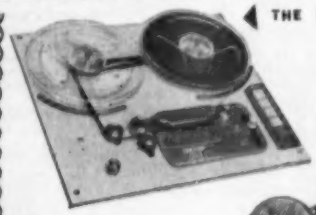
● We will supply it COMPLETE & READY FOR USE or YOU CAN ASSEMBLE IT AT HOME.

We have long delayed producing a Tape Recorder until we were completely satisfied that not only could we supply it at a genuinely low price, but also it had to be completely dependable and in addition it had to provide absolute fidelity recordings. !! THIS WE HAVE DONE !! and we offer our "Fidelity" model with the utmost confidence and with the knowledge that its performance equals Recorders marketed at a far higher price. It incorporates the Tape Deck and Amplifier described below both of which are so arranged that the "home assembly" of the Recorder is quickly and easily achieved.

SEND S.A.E. FOR DESCRIPTIVE LEAFLET

YOU CAN ASSEMBLE IT YOURSELF FOR £40

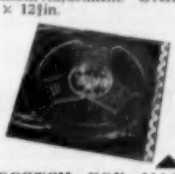
H.P. Terms are shown below. THE DECK AND AMPLIFIER ARE ASSEMBLED AND TESTED WHEN SUPPLIED. The actual assembly of the Recorder is extremely simple and only involves a few connections. The Truvox Tape Deck and the Amplifier are supplied tested and ready for use, all that is required is to connect the two together (a connection chart is supplied) and secure them in the Attache Case.



THE NEW TRUVOX MODEL TR7U TAPE DECK

THE NEW TRUVOX MODEL TR7U TAPE DECK. 3 Shaded-Pole motors. Drop-In Tape Loading. Push Button Control. Separate Push Button Brake. Fast-forward and fast-reverse. Silent drive eliminating Wow and Flutter. Half Track working and 2 speeds, 3¾in. and 7½in. per sec. Positive Azimuth Adjustment. Overall size only 14¼in. × 12¾in.

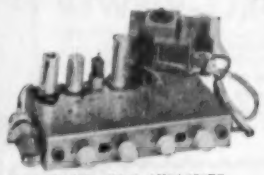
ACOS CRYSTAL MICROPHONE MODEL MIC-33-1. A highly sensitive mike which accurately matches the input arrangement of the amplifier



SCOTCH BOY MAGNETIC RECORDING TAPE. Supplied with a 1,200ft. reel of Scotch Boy plastic tape famous for its true brilliant quality. The Recorder will take all standard makes of tape

BRIEFLY:

MODEL TRIF QUALITY AMPLIFIER. Expressly designed to correctly operate with the above Truvox Deck for recording and playback. Supplied complete with Elliptical Speaker and has level response from 60-10,000 c.p.s. Hum level 50 db down at 4 watts. Incorporates efficient tone control arrangement and MAGIC EYE-LEVEL INDICATOR. Valve line-up: EF86 ECC83, EL84 5Y3, EM34, provides 4 watts undistorted.



MODEL TRIF AMPLIFIER

THE ATTACHE CASE illustrated is attractively finished and covered with Rexine and is only 18in. × 14in. × 8½in. It has a concealed pocket to accommodate the Mike and Mains lead and also a pocket to carry a spare reel of tape.

GUARANTEED FOR 12 MONTHS (B.V.A. VALVES 90 DAYS)

PRICE SUMMARY

EACH UNIT IS AVAILABLE SEPARATELY AS FOLLOWS:

	CASH PRICE	DEPOSIT	12 monthly payments of
(a) TRUVOX Mk. TR7U TAPE DECK	£23 2 0	£5 17 0	£1 12 4
(b) AMPLIFIER MODEL TRIF WITH SPEAKER	£14 14 0	£4 16 —	£1 0 5
(c) PORTABLE ATTACHE CASE	£5 0 0	—	—
(d) ACOS CRYSTAL MIKE "33"	£2 10 0	—	—
(e) REEL OF TAPE 1,200FT.	£1 15 0	—	—

Please include £1 when ordering (a), (b) or (c) for packing charge this whole amount will be refunded if case is returned to us intact.

WE WILL SUPPLY ALL FIVE UNITS LISTED ABOVE, i.e. THE COMPLETE BUT UNASSEMBLED RECORDER FOR £40/-/-. H.P. Terms: Deposit £10 and 12 monthly payments of £2/15/10 or in two par s as follows:—

	CASH PRICE	DEPOSIT	12 monthly payments of
(a) TRUVOX Mk. TR7U TAPE DECK MODEL TRIF AMPLIFIER WITH SPEAKER. 1,200FT. REEL OF TAPE	£33 10 0	£8 10 0	£2 6 8
(b) ATTACHE CASE AS ILLUSTRATED .. LACOS CRYSTAL MICROPHONE ..	£6 10 0	—	—

See note below re packing charge.

NOTE: Please send 30/- to cover cost of packing, carriage and insurance. We will refund £1 if the packing case is returned to us intact.

SUPPLIED COMPLETE AND READY FOR USE £50

FOR USE ON A.C. MAINS

H.P. Terms: Deposit £12 10 0 and 12 monthly payments of £3 10 0

Including mike and 1,200ft. reel of tape.

STERN RADIO LTD.

109 and 115 FLEET STREET, LONDON, E.C.4

Phone: CENtral 5812-3-4

YOU'RE SURE TO GET IT AT STERN'S

BY FAR THE BEST FOR HOME CONSTRUCTORS!

The "TELE-VIEWER"

5 CHANNEL TELEVISOR

DESIGN OF A COMPLETE 12" SUPERHET T.V. RECEIVER

PERFECT PICTURE QUALITY – SIMPLE DIAGRAMS MAKE CONSTRUCTION EASY

PERFECT FRINGE AREA RECEPTION – BETTER RECEPTION AT HALF COMMERCIAL COST

Here are some of the features which combine to make this such a fine receiver.

- The Superhet circuit easily tuned to any o' the five channels, i.e., LONDON, SUTTON COLDFIELD, HOLME MOSS, WENVOE and KIRK-O-SHOTTS. (The extreme ease of tuning is accomplished by the provision of pre-aligned I.F.T.s.)
- A lifelike, almost stereoscopic, picture quality made possible by the following factors:
  - a. Excellent band width of I.F. circuits.
  - b. A really efficient video amplifier.
  - c. C.R.T. Grid modulated from low impedance source.
  - d. High E.H.T. voltage (approx. 10 kV.).

  The picture brilliance is also much above the average and enables comfortable viewing with normal room lighting or daylight.
- FIRM picture "HOLD" circuits (Frame-Line) ensure a steady picture free from bounce or flicker even under the most adverse conditions met with in "fringe" areas and excellent "interlace" ensures the absence of "liney effect."
- Negative feedback is used in the audio frequency circuits which provide 2/3 watts of High Quality Sound.
- Entire receiver built on two chassis units each measuring 14½in. x 6½in. x 3½in.
- Rigid C.R.T. mounting enables entire receiver to be safely handled with tube in position.

●All pre-set-controls are mounted on side of chassis, enabling all adjustments to be carried out whilst facing the C.R. Tube.

This complete TELE-VISOR, including all Valves, can be built for only (Plus cost of C.R.T.) **£28/16/4**

As no hire purchase terms are available the receiver can be bought in five separate stages (practical diagrams and circuits are provided for each stage) thus enabling hire purchase interest rates to be avoided. The complete set of ASSEMBLY INSTRUCTIONS is available, price 5/-. The instructions include really detailed PRACTICAL LAYOUTS, WIRING DATA AND COMPONENT PRICE LIST. ALL COMPONENTS ARE AVAILABLE FOR INDIVIDUAL PURCHASE.

NOW AVAILABLE AT STERN'S

The "WIDE ANGLE" TELE-VIEWER

- A design that retains all the distinctive features of the 12in. Televisor but with increased Time Base efficiency, producing 15 to 16 kV. E.H.T., with ample scanning power for C.R. Tubes up to 17in.
- It can be completely built including supply of all valves for **£33** (plus cost of C.R.T.) and is as simple to construct as the 12in. model.
- This is the most efficient "WIDE ANGLE" large screen design yet offered to constructors, and yet it can be built for almost half the cost of similar designs.
- Complete assembly instructions, diagram, etc., available for 5/-.

WE CAN SUPPLY . . . COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER. Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two M709's in Push Pull.
The Assembly instructions include five "easy stage-by-stage" diagrams and is available for 3/6.
Price of COMPLETE KIT **£23/10/-** (Plus 7/6 Carr. and Ins.)
WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for **£25/-/-** (Plus 7/6 Carr. & Ins.)
H.P. Terms: £6/5/-, Deposit and 12 months at £1/15/2.

The DENCO M.T.O.I. Modulated Test Oscillator £3/15/-

(Plus 2/- carr and ins.)
Has Frequency range continuously variable from 170-475 Kc/s. and 550-1,600 Kc/s. Battery operated and thereby completely self-contained.

SELENIUM RECTIFIERS

6 or 12 volt 1 amp. rating	7/6
6 or 12 volt 2½ amp. rating	12/6
6 or 12 volt 4 amp. rating	17/6
6 or 12 volt 6 amp. rating	£1/2/9

BRAND NEW C.R.T. MASKS

Latest aspect ratio for 12in. "Round" tubes, finished Ivory (plus 1/- postage) **12/6**

SPEAKER BARGAINS

PLESSEY, 10in. 3 ohm V/coil	£1/5/0
GOODMANS 10in. 2 ohm V/coil	£1/13/6
TRUVOX, 12in. 3 ohm V/coil	£2/7/6
ROLA, 12in. 3 ohm V/coil	£3/19/6
BAKERS, 12in. 15 ohm V/coil	£4/19/6
GOODMANS, 12in. 15 ohm V/coil	£5/19/6

(Carriage and Ins. 1/6 extra.)

WE HAVE IN STOCK . . . THE DENCO F.M. FEEDER UNIT

Consisting of a 5 valve Superhet design incorporating R.F. (6AM6) and F/C (12AH8) Stages followed by Two I.F.s. (6BA6's) and Ratio Descriminator (6AL5), the coverage provided being 88-100 Mc/s.
THE COMPLETE KIT including VALVES and DRILLED CHASSIS is available for **£6/13/6** (plus 4/- carriage and insurance)
It is suitable for use with any type of High Fidelity Amplifier.
The descriptive manual, including circuit and Component, Layout etc., is available for 1/6.

THE COMPLETELY ASSEMBLED CHASSIS, ready for use, aligned and tuned **£8/17/6** (plus 6/- carriage and insurance).

THE NEW W.B. "STENTORIAN" HI FI SPEAKERS ARE IN STOCK

Model H.F. 6-inch	£2/10/6
Model H.F. 9-inch	£2/7/0
Model H.F. 8-inch	£3/0/6
Model H.F 10-inch	£3/13/6

These speakers are of the very latest design and provide quality reproduction for the lower-price range, 3 or 15 ohm models are available.

WE CAN SUPPLY EX-STOCK

(a) The Editor Tape Recorder complete	£47/5/0
(b) The Truvox Tape Deck	£23/5/0
(c) The Grundig Model TK9 Tape Recorder, complete	£68/5/0
(d) The Grundig Model 700L Tape Recorder, complete	£84/0/0

Each is available on Hire Purchase and descriptive leaflets are available—send S.A.E.

WE CAN SUPPLY . . . COMPLETE KIT or ASSEMBLED CHASSIS THE MULLARD HIGH QUALITY AMPLIFIER

A design by Mullard Ltd. of a quality 5 valve 10 watt Amplifier incorporating the latest Mullard valve line-up with two KL34's in push-pull.
PRICE COMPLETELY ASSEMBLED TO SPECIFICATION **£18/10/-** (Plus 7/6 Carr. and Ins.)
H.P. Terms Deposit £4/12/-, 12 months of £1/6/1.
Price of complete kit £17/10/-. (Plus 7/6 carr. and ins.)
The Mullard Assembly Manual is available for 2/6.

BATTERY CHARGER KITS

All kits are for A.C. Mains 200-250 volts. They comprise a Metal Rectifier and Transformer, tapped for 6 or 12 volt charging, and a tapped Resistor, with Selector Switch, to enable the charging rate to be varied. A M/coil meter 5 amp. max., 13/6 extra.
For 6 or 12 volt batteries at max. 1 amp... £1/17/6
For 6 or 12 volt batteries at max. 2½ amp. £2/5/3
For 6 or 12 volt batteries at max. 4 amp. £3/2/6
An easily followed Wiring Diagram is included with each kit.

FILAMENT TRANSFORMER

6.3 v. 1½ a.	5/9
4 v. 1½ a.	5/9

When submitting orders, please include postage and packing

STERN RADIO LTD.

RECEIVER CHASSIS — *Modernise your old Radiogram* — RECORD PLAYERS

COMPLETE RADIOGRAM EQUIPMENT—QUALITY AT LOW COST

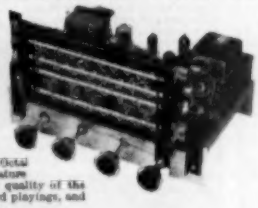
STERN'S DESIGN FOR HOME CONSTRUCTORS
The "SUPER-SIX"

A compact and highly efficient superhet Radio-Radiogram chassis of outstanding quality.

YOU CAN BUILD IT FOR £10/7/6

Including the OCTAL VALVE LINE-UP

(£12/7/6 with the miniature valves)



Incorporating the new B.V.A. Miniature Valve Line up. This receiver is designed to the very latest specification and provision is made to incorporate either the standard Octal Valve Line-up or the new B.V.A. range of miniature valves. Great attention has been paid to the quality of the reproduction of both Radio reception and Record playings, and excellent clarity of speech and music is obtained.

A few brief details.

- Covers 3 waveбands 16-50 metres, 190-550 and 800-2,000 metres.
- Employs 6 valves having PUSH-PULL for 5-6 watts output.
- Incorporates delayed A.V.C. on all waveбands and pre-selective feedback.
- A 4 position Tone Control operation on both Radio and Gram.
- Has independent mains supply socket for a Record Player.
- Size of Assembled Chassis 12in. × 8in. × 8in. Dial aperture 8¼in. × 4¼in.
- For operation on A.C. mains 200-250 volts 50 cycles.

THE INSTRUCTION and ASSEMBLY MANUAL is available for 2/-. It contains very detailed practical drawings and circuit diagrams and a complete Component Price List.

!!! THE LATEST !!!
RADIO-RADIOGRAM CHASSIS

Model F3PP. A 7-valve 3-waveband Superhet Chassis with Push-Pull Stage. This Chassis has been designed with particular regard to the quality of reproduction. It incorporates SEPARATE BASS and TREBLE CONTROLS thereby ensuring the utmost flexibility of Tone on both Radio and Gram.

Briefly:

- Waveband coverage 16-50, 190-550 and 800-2,000 metres.
- Valve line-up X79, 6BA6, 6AT6, ECC83, GZ30 and two 6AQ5's in push-pull for approx. 6 watts output.
- Negative Feedback and delayed A.V.C.
- Has independent mains supply socket for gram. connection.
- Overall size of Chassis 13in. × 8in. high × 7in. with dial size 11¼in. long × 4¼in.

For use on A.C. Mains 100/110 volts and 200/250 volts.

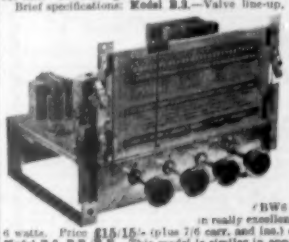
Cash Price, tested and ready for use **£17/17/0** (plus 7/6 carr. and ins.)

H.P. Terms: Deposit £4/7/0 and 12 monthly payments of £1/5/4.

THREE COMPLETELY ASSEMBLED ALL-WAVE SUPERHET CHASSIS

- Model S.3. A 5-valve 3-waveband receiver.
- Model S.3.P.P. A 6-valve 3-waveband Receiver with PUSH-PULL OUTPUT.
- Model S.3.P.P./R.F. A 7-valve 3-waveband Receiver incorporating an R.F. stage with PUSH-PULL OUTPUT.

The three Receivers are for operation on A.C. mains 100/110 volts and 200/250 volts, and employ the very latest miniature valves. They were designed to the most modern specification great attention having been given to the quality of reproduction which gives excellent clarity of speech and music on both gram. and radio, making them the ideal replacement chassis for that "old Radiogram," etc.



Brief specifications: **Model S.3.**—Valve line-up, 6BE6, 6BA6, 6AT6, 6BW6, 6X4—waveband coverage short 16-50, medium 187-550, long 940-2,000 metres. Controls: (1) volume with on/off; (2) tuning (flywheel type); (3) wavechange and gram.; (4) Tone Control (operative on gram. and radio). Negative feedback is employed over the entire audio stages. Chassis size: 11 × 7½ × 8¼in. high. Dial size 9½ × 4¼in. Price complete and READY FOR USE, excluding speaker £13/13/- (carr. and ins. 7/6 extra).
H.P. Terms £3/4/- deposit, 12 months at 17/8.

Model S.3.P.P. This model is the S.3 Receiver but incorporates two 6BW6 VALVES in PUSH-PULL, resulting in really excellent quality reproduction up to approximately 6 watts. Price £15/15/- (plus 7/6 carr. and ins.) or £3/19/- deposit, 12 months at £1/2/2.

Model S.3. P.P. R.F. This model is similar in appearance and has same waveband coverage as the Model S.3, but in addition it incorporates an R.F. STAGE together with PUSH-PULL OUTPUT, employing a total of 7 valves with two type 6BW6 in Push-Pull. This makes for a really sensitive receiver with genuine quality reproduction. Price £18/18/- (plus 7/6 carr. and ins.) or £4/13/- deposit, 12 months at £1/6/9.

109 and 115 FLEET ST., London, E.C.4. 'Phone: CENtral 5812/3/4

This 3-SPEED AUTOCHANGER is by a Famous Manufacturer and is offered for

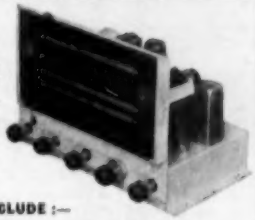
£11/10/0 (Plus 7/6 carr. & ins.) Normal Price £16/10/0

Hire Purchase Terms £2/17/6 Dep. and 12 months at 16/4.

- These units will autochange on all three speeds, 7in., 10in. and 12in.
- They play MIXED 7in., 10in. and 12in. records.
- They have separate sapphire for L.P. and 78 r.p.m., which are moved into position by a simple switch.
- Minimum baseboard size required 14in. × 12½in., with height above 5¼in. and height below baseboard 2¾in. A bulk purchase enables us to offer these BRAND NEW UNITS at this exceptional price.

THE NEW ARMSTRONG F.C. 48

A high quality replacement Radio or Radiogram Chassis having provision for an F.M. Feeder Unit.



PRICE ASSEMBLED and READY FOR USE **£23/18/0**

(Plus 7/6 Carr. and Ins.)

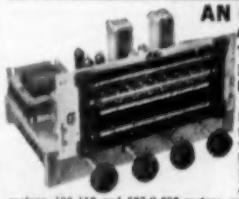
H.P. Terms £5/18/- Deposit and 19 months at £1/13/9.

OUTSTANDING FEATURES INCLUDE :—

- 5 Valves including 2 double Triodes.
- 3 Watts output from push-pull tetrodes. Heavy negative feedback is used, resulting in negligible distortion and high damping factor.
- Provision for using F.M. adaptor to receive the present high quality transmissions from Wrotham and the new B.B.C. V.H.F. stations.
- An accessible socket at rear provides the power supply for this unit.
- Independent controls give BASS and TREBLE lift and cut with unique Thermometer visual indicator.
- Gram. position on wavechange switch.
- 4 Waveбands Coverage 16-51, 50-120, 190-550, 1,000-2,000 metres.
- Large four-colour illuminated dial.

AN OUTSTANDING OFFER

A BULK PURCHASE ENABLES US TO OFFER THIS "PUSH-PULL" 7 VALVE SUPERHET RECEIVER



For only £12/19/6 (Carr. & ins. 7/6 extra.)

H.P. — £3/4/6 Dep. 12 mths. at 18/4.

These receivers Model A.W.3-7 are made by a well known set of manufacturers and incorporate the latest Octal Valve Line-up of X79—W77—DH77—H77—U78 and two N78's in Push-Pull for approx. 7 watts output. They cover 3 waveбands 16-50 metres, 190-550 and 800-2,000 metres, and are for operation on A.C. mains 200-250 volts. A Gram. position is on the Wavechange Switch.

They make an excellent replacement Radiogram Chassis having a P.U. connection on the chassis. Extension speaker connection is also provided. Overall size of chassis: 12in. long × 7¼in. × 6¼in. high, dial aperture 8¼in. × 4¼in. (Dial Escutcheon available for 4/6).

THESE RECEIVERS ARE BRAND NEW AND FULLY GUARANTEED.

The NEW COLLARO 3-SPEED UNIT MODEL 3/554.

£8/18/4 (Plus 5/- carr. and ins.)

- A Non-Autochange 3-speed unit having the new lightweight STUDIO "O" CRYSTAL PICK-UP.
- Will play 7 and 10in. and 12in. records.
- THE VERY LATEST MODEL.

SPECIAL REDUCTIONS FOR COMPLETE EQUIPMENT

SUMMARY—Select a RECEIVER CHASSIS and we will supply it TOGETHER WITH THE ABOVE 3-SPEED CHANGER AND AN 8-inch or 10-inch P.M. SPEAKER as follows:—

THE £11/10/- AUTOCHANGER WITH A SPEAKER AND:—

	Cash Price	Deposit	Monthly
(a) With Model S3 chassis	£24 15 0	£6 4 0	19 at £1 14 10
(b) " " S3PP	£26 5 0	£7 0 0	19 at £1 18 7
(c) " " S3PP/RF	£27 2 0	£7 15 0	19 at £2 3 0
(d) " " Armstrong F.C.48	£30 4 0	£9 1 0	19 at £2 10 1½
(e) " " AW3-7	£25 5 0	£6 5 0	19 at £2 1 7½
(f) " " F3PP	£30 2 0	£7 10 0	19 at £2 17 6

An additional charge of 10/- is made in each case to cover Carriage and Insurance.

"Hi-Fi" EQUIPMENT and KITS
TO SUIT ANY BUDGET

TWO COMPLETE "Hi-Fi" AMPLIFIER KITS

"STERNS" HIGH QUALITY 8-10 WATT AMPLIFIER

Having a front panel which is very attractively finished in deep gold, and on which the controls are clearly identified. The ideal amplifier for general home use and for small halls, etc.

Price of COMPLETE KIT including Valves and Drilled Chassis, etc. **£7/10/-** (Plus 2/6 Carr. & Ins.)

We will supply it Completely Built for **£9/10/-** (Plus 5/- Carr. & Ins.)

Designed for high quality reproduction up to an output level of 10 watts, having 6V6s in Push-Pull and incorporating negative feedback. It is suitable for use with all types of Pick-ups and most types of microphones and the output transformer provides for use of 3 and 15 ohms speakers.

BRIEF FEATURES

- **Valve** line up 6S7, 6SJ7, 5Z4, with 6V6s in push pull.
- The undistorted output level of up to 10 watts is produced from an input of .25 volts.
- First class reproduction of Radio (where a Tuning Unit is used) and Record Playing.
- Separate Bass Boost and Treble Controls provide an excellent range of frequency control.
- Very satisfactory results are obtained with an average type of high impedance Moving Coil or Crystal Microphone, a clear speech level of approx. 5 watts output being obtained.
- Power supplies (HT and LT) are available for a Tuning Unit.
- For operation on A.C. Mains 200-250 volts 50 cycles.

THE ASSEMBLY MANUAL is available for 1/- and includes detailed Layouts and component Price List.

"STERNS" 12 Watt "HIGH FIDELITY" Push-Pull AMPLIFIER

A very high quality Unit attractively finished in deep gold with each control clearly identified on the front panel. Comprising a Main Amplifier Chassis and a Remote Control Pre-Amplifier-Tone Control Unit. The remote control unit measures only 9in. x 6in. x 2¼in. and contains four controls, being: Bass-Treble-Volume and a Radio, Gram, Microphone Switch control. It incorporates its own feedback circuit on the Bass Channel. Loop negative feedback is employed on the Main Amplifier which has a valve line up of 6J5-6N7-5U4 with two PX25's in push-pull and 6J5 and 6BN7 are used in the remote control unit.

THE COMPLETE KIT IS AVAILABLE FOR **£14/-/-** (Carr. & Ins. 6/- extra.)

THE COMPLETE UNIT ASSEMBLED AND READY FOR USE **£17/-/-**

H.P. Terms £4/5/- Deposit, 12 Months at £1/3/11. (Carr. & Ins. 7/6 extra.)

The measured frequency range of the amplifier with this unit shows an excellent response from 14,000 cycles down to 20 cycles, the bass and treble controls allowing independent control of gain at both ends of the frequency range from zero to a gain of 50. It can be seen, therefore, that ample correction is provided to suit any type of pick-up with any type of recording. Input voltage for maximum output is 70 mV and 6.3 volts at 2 amps, and 30 mA. H.T. is provided for tuning unit, etc. **This Amplifier compares well with the Williamson and similar designs at a fraction of their cost. The complete set of assembly instructions is available for 2/-.**

SPECIAL PRICE REDUCTIONS
FOR COMPLETE EQUIPMENT

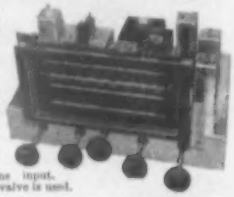
SELECT A TUNING UNIT and AMPLIFIER or TUNING UNIT, AMPLIFIER and RECORD PLAYER (and a SPEAKER if required) and we will supply at a **REDUCED PRICE.** *H.P. TERMS ALSO QUOTED.*

"STERNS" MODEL C.P.3. COMBINED AM/FM TUNING UNIT

A UNIT DESIGNED TO RECEIVE BOTH THE A.M. and F.M. BANDS WITH THE VERY HIGHEST DEGREE OF QUALITY.

A.M. TUNER SECTION. This employs a 4 valve 3 waveband circuit incorporating 2 stages of I.F. Amplification switched to provide bandwidths of 7.10 and 14 kc/s. Valve line-up: X79 (Mixer) W77 (I.F. Amplifier) W77 (2nd I.F. Amplifier) DH77 (Detector A.V.C and 1st A.F. Amplifier).

F.M. TUNER SECTION. This is a design incorporating a wide band R.F. stage followed by a frequency changer which has a variably tuned oscillator enabling the band 88-100 mc/s to be covered. Two stages of I.F. Amplification provide excellent sensitivity and a ratio type discriminator stage gives high output with good A.M. rejection.



SWITCHING. A three position switch incorporated into the chassis enables the F.M. Tuner or the A.M. Tuner, or gramophone pick-up to be selected. This switch also switches the H.T. supply to the tuner selected. The Triode section of the DH77 in the A.M. circuit is also controlled by this switch and becomes the first A.F. amplifier not only for the A.M. Tuner but for the F.M. tuner and gramophone pick-up also. A volume control is provided for all three.

POWER SUPPLIES. Adequate H.T. and L.T. supply is obtained from the built-in mains power pack for 200-250 v. A.C. mains input. Full wave rectification with a 5Z4 rectifier valve is used.

TUNING. A common tuning control covers both the A.M. and F.M. bands. The dial is calibrated with station names and wave lengths for the A.M. channels and has a logging scale for the short wave and F.M. bands.

CHASSIS DIMENSIONS. 14in. x 9in. x 8in. overall including a three coloured full vision dial. Size 8¼in. x 4¾in.

PRICE, ASSEMBLED AND READY FOR USE £25/10/-.
(Plus 10/- carriage and insurance.)
H.P. Terms. Deposit **£5/7/6** and 12 months at **£1/15/10.**

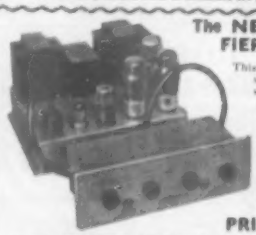
"STERNS" MODEL CP3G 3 WAVEBAND SUPERHET TUNING UNIT

A highly sensitive tuning unit providing for excellent reception of stations on the short wavebands (16-50 metres) medium waveband (200-550 metres) and the long waveband (850-2,000 metres).

- Valve line-up — 6K8G (Frequency Changer), 6BK7g (I.F. Amplifier), 6Q7g (Detector, AVC and 1st A.F. Amplifier), and 5Z4g (rectifier).
- A gramophone position is incorporated with the wavechange switch and the 6Q7g valve becomes the 1st A.F. Amplifier for the gramophone pickup.
- Volume control and tone control operative in both radio and gramophone positions of the wavechange switch.
- This unit is precisely similar in appearance to the **AM/FM** unit illustrated, but the overall chassis dimensions are 12in. x 8¼in. x 8in. including the full vision dial. Size 8¼in. x 4¾in.
- For A.C. Mains only, power supply required—H.T. 250 volts 30 mA, L.T. 6.3 volts 1½ amp.

Price, completely assembled and including built-in power supply **£10/10/-.** H.P. Terms. Deposit **£2/12/6.** 12 months of 15/-.
Price completely assembled excluding power supply **£9/-/-.** Carriage and insurance 7/6 extra.

The NEW "LEAK" TL/10 AMPLIFIER and "Point One" PRE-AMPLIFIER



This Amplifier has a maximum output of 10 watts and maintains in every respect the world renowned LEAK reputation for precision engineering, fine appearance and fastidious wiring. The Pre-Amplifier will operate from any make or type of pickup. A continuously variable input attenuator at the rear of the Pre-amp. permits the instantaneous use of crystal, moving iron and moving coil pickups. H.T. and L.T. supplies are available for a Radio Tuning Unit. An input attenuator is fitted. S.A.E. for descriptive leaflet.

PRICES :

(a) The **COMPLETE AMPLIFIER WITH PRE-AMPLIFIER**, £23/7/-, or **£7/2/-** Deposit and 12 months at **£2.**
(b) The **TL/10 MAIN AMPLIFIER ONLY: £17/17/-**, or **£4/7/-** Deposit and 12 months at **£1/6/4.**
(c) The **"POINT ONE" PRE-AMPLIFIER ONLY: £10/10/-**, or **£2/12/6** Deposit and 12 months at **15/-.**

WILLIAMSON AMPLIFIERS BY GOODSELL

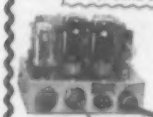
These Amplifiers hardly need enlarging upon, it being sufficient to say that they have now become the accepted standard for quality reproduction by which all others are judged. Two Models are available:

MODEL G.W.18. Built completely to specification and giving 15 watts output.
Price **£33/15/-** (plus 7/6 carriage and insurance.) H.P. Terms. Deposit **£8/9/-** and 12 months at **£2/7/6.**

MODEL G.W.12. Uses slightly lower H.T. voltage to produce 10-12 watt output but otherwise is built completely to specification.
Price **£27/10/-** (plus 7/6 carriage and insurance.) H.P. Terms Deposit **£6/17/6** and 12 months at **£1/15/6.**

THE MODEL P.F.A. TONE CONTROL UNIT
This Control Unit has established a reputation for its excellent quality of reproduction, and ability to give adequate gain for any type of pick-up.
Price **£20/-/-** (plus 7/6 carriage and insurance). H.P. Terms. Deposit **£5/-/-** and 12 months at **£1/3/2.**

WE HAVE THEM IN STOCK AND WILL BE PLEASED TO DEMONSTRATE
or send S.A.E. for illustrated and descriptive leaflet.



THE GOODSELL "ULTRA LINEAR" M.A.S. AMPLIFIER
A "High Fidelity" Amplifier using a Triode connected push-pull output stage providing 10-12 watts output.
Price **£14/17/6** (plus 7/6 carriage and insurance).
H.P. Terms Deposit **£3/12/6** and 12 months of **£1/1/1.**

THE TONE CONTROL—PREAMP. UNIT
Recommended for this Amplifier is the model ULW/T.C. Its main features are adequate equalising for gramophone reproduction, separate control of bass and treble and low pass filter. Feedback is used over each of four stages. Price **£12/12/-** (plus 6/- carriage and insurance).
H.P. Terms. Deposit **£3/4/-** and 12 months at **17/6.**

When submitting orders, please include postage and packing.

STERN RADIO LTD.

CONSTRUCTORS say "IT'S STILL THE BEST MAINS or BATTERY PORTABLE SET"

A Midget 4-valve Superhet Portable covering medium and long wavebands. Designed to operate on A.C. mains 200/240 volts or by an "Alldry" battery. The set is designed so that the mains section can be supplied as a separate unit, and can be added at any time. The set supplied as an "Alldry" battery Superhet can be accommodated in the attache case illustrated (size 9½in. × 4½in. × 7in.). This is attractively finished in tinard, maroon, dark green or blue rexine. As a combined Mains/Battery Superhet Portable a polished cabinet is available to accommodate both Mains Unit and Batteries. Circuit incorporates delayed A.V.C. and pre-selective Audio Feedback. The set is complete in every detail and includes ready-wound frame aerials, fully aligned I.F. transf. and drilled chassis, etc. Overall size of assembled chassis 8in. × 4in. × 2½in. This receiver, as illustrated, can be completely built for **£8/16/3** (plus Mains Unit if required). Send 1/3 for the fully descriptive Assembly Book which includes Practical Layouts and complete Price List of Components. Attache case available separately, **37/6**.

THE "MINI TWO-THREE"

An "Alldry" Battery Portable of midget size, 6½in. × 4½in. × 3½in. designed to cover medium waveband 190-559 metres, with use of short trailer aerial.

The simple design of this Receiver is so arranged that either a 2-valve set or a 3-valve (afterwards easily converted to the 3-valve) can be made.

Consists of a T.R.F. circuit using a regenerative detector with H.F. stage and a high gain output pentode. Valve line up 1T4—1T4—1S4.

The 3-valve set can be completely built for **£4/3/6** (less case) and the 2-valve for **£3/3/-** (less case). Each price includes valves, speaker, and drilled chassis.

Send 2/- for the assembly instructions: they include simple and complete practical component layouts and diagrams which enable the most inexperienced constructor to successfully build either set.

"PERSONAL SET" BATTERY ELIMINATOR

A complete Kit of parts to build a Midget "Alldry" Battery Eliminator, giving approx. 69 volts and 1.4 volts. This eliminator is for use on A.C. mains and is suitable for any 4-valve Superhet Receiver requiring H.T. and L.T. voltage as above, or approx. to 69 volts.

The Kit is quite easily and quickly assembled and is housed in a light-aluminium case size 4¾in. × 1¾in. × 2¾in. Price of complete Kit with easy-to-follow assembly instructions, **42/6**.

In addition we can offer a similar COMPLETE KIT to provide approx. 90 volts and 1.4 volts. Size of assembled unit 7in. × 3¼in. × 1¾in. Price **47/6**.

A COMPLETE "CAR RADIO" FOR THE HOME CONSTRUCTOR

11¼in. × 4¾in. × 3¼in.

A design of a complete 5-VALVE SUPERHET RECEIVER employing one R.F. Stage, and incorporating a separate VIBRATOR PACK size 4½ × 2½ × 6¼in. for use on 6 or 12 volt D.C. supplies.

We can supply all components to build this complete Receiver and Vibrator Pack including a Metal Case, Valves, Drilled Chassis and 5in. P.M. Speaker for **£12/9/6**. (Carr. and Ins. 5/6 extra.) Or the Receiver Components for **£9/19/6** and the Vibrator Components for **£3/10/-**.

This is NOT an EX-GOVT. Receiver, it is a new design employing new Components. Send 2/6 for the complete set of ASSEMBLY INSTRUCTIONS, CIRCUITS and PRACTICAL LAYOUTS, including a complete individual Component Price List.

A BULK PURCHASE ENABLES THIS SPECIAL PRICE REDUCTION OF THE FAMOUS SHAFTESBURY PORTABLE AMPLIFIER

Suitable for home use and small Halls. Has matched inputs for both Record Players and Microphone. Also provides for the "mixing" and "fading" of both Gram. and speech as requested.

COMPRISING

(a) A 4-Valve High Gain Amplifier for use on A.C. or D.C. mains 200-250 volts with 5 watts output. Incorporating independent Volume Controls for Mike and Gram. either of which can be faded at will, a variable Tone Control and independent input sockets for Mike and Gram.

(b) A Transverse Carbon microphone which obtains its polarising current from the amplifier—no batteries are necessary.

(c) An 8in. Goodmans P.M. Speaker with the "Ticonal" magnet for first-class reproduction.

THE COMPLETE EQUIPMENT is all contained in the **PORTABLE CARRYING CASE £18'0'0**

Having been reduced from £30/9/-. HIRE PURCHASE TERMS. DEPOSIT **£4/10/-** and 12 monthly payments of **£1/5/4** ● Light in weight ● Easy to CARRY ● GENUINELY PORTABLE. An illustrated leaflet containing free data is available on receipt of S.A.E.

!! CONSTRUCTORS !! A NEW SUPERHET TRANSPORTABLE THE "SUPER THREE"

Designed for local station reception without the use of an external aerial. This design provides for a 3-valve (plus Metal Rectifier) Superhet Receiver incorporating a Frame Aerial for "room to room" use, provision is also made for a short external aerial, if required, for the reception of Continental Stations.

Briefly the features are as follows:—

- For use on A.C. Mains 200-250 volts.
- This set includes a Mains Transformer and Chassis is NOT live to mains (as many other sets of this type are) and consequently the Receiver can safely be used in the Kitchen, etc.
- Valve line up 6K8—6J7—KT61, plus Metal Rectifier.
- The I.F. Transformer is supplied "pre-aligned" and thereby ensures extreme simplicity of Tuning—in fact, more simple than most T.R.F. Receivers.
- Compact and easy to build simple "point to point" practical diagrams are supplied with a completely drilled chassis.

The complete Receiver Chassis can be built to cover the Medium Waveband only for **£6 . 6 . 6**

Or to cover both Long and Medium Waves for **£6 . 16 . 3**

The attractive Polished Wood Cabinet 11½ inches wide, 8½ inches high and 6 inches deep illustrated above is **£1 . 1 . 0**

The CONSTRUCTOR'S MANUAL is available for 1/-, this shows the component prices, which are all available for separate purchase.

A DUAL-CHANNEL PRE-AMPLIFIER and TONE CONTROL UNIT

Attractively finished in "Old Gold" and providing full control of BASS and TREBLE in conjunction with a main volume control.

It can be used with any amplifier and with any pick-up, the range of frequency control provided by the unit affording ample compensation for all types of pick-ups and all natures of recordings, i.e., English, American and long-playing, without recourse to pick-up correction. The extreme flexibility of the bass and treble control is such that the level of bass and treble can be set to suit any conditions irrespective of the volume output of the amplifier. Response characteristics are given in 15-watt amplifier advt. The unit measures only 9in. × 4in. × 2½in., including self-contained power supply and can be accommodated either on or away from the main amplifier, i.e., on the front panel of a cabinet or any other position. Price including drilled chassis, valves (6BN7 and 6J5), **£3/16/9**. Complete assembly data are available *separately* for 1/-. Completely assembled and ready for use, **£5/5/-**.

"MINI-TWIN" 1-VALVE BATTERY SET

A design of a simple 1-valve 2-stage Battery Receiver, giving excellent results on medium and long wavebands and having exceptionally low battery consumption. Drilled chassis and practical diagrams make it the ideal set for the beginner to build.

The complete chassis, including valve, can be built for **37/6**, plus 5/11 P/Tax, the attractive plastic case is **9/6**, and suitable headphone, **14/3**.

The complete assembly instructions, layouts and a component price list are available for **1/6**.

A COMPLETELY ASSEMBLED 4 VALVE T.R.F. CHASSIS

Including a 5 in. P.M. SPEAKER and VALVES

£6/9/6 (Plus 7/6 carr. and ins.)

This receiver is of the very latest design and is for use on A.C. or D.C. Mains. It covers both Long and Medium Wavebands, and includes the modern 8V.A miniature valves. The line up being 12BA6 — 12AT6—12AV6—35W4. It incorporates Permeability Tuned Coils, thus ensuring excellent selectivity and sensitivity. The overall size of the complete chassis including speaker is 10½in. × 4½in. × 6½in. An attractive Cabinet size 11½in. × 5½in. × 6½in. is available for **16/6** (plus 2/6 carriage and insurance).

109 and 115 FLEET ST.

LONDON, E.C.4. *Phone:* CENTRAL 5812-3-4

Volume Controls

Midget type. Long spindles. Guaranteed 1 year. All values 10,000 ohms to 2 Meg-ohms.

No Sw.	S.P.Sw.	D.P.Sw.
	3/-	4/9

COAXIAL PLUGS	1/2
SOCKETS	1/-
LINE CONNECTOR	1/2
OUTLET BOXES	4/6

80 ohm CABLE COAXIAL

STANDARD ¼in. diam. Polythene insulated. GRADE "A" ONLY

8d. yd.

SPECIAL—6mm-air spaced Polythene. 80 ohm Coaxial ¼in. diam. Stranded core. Losses cut 80% (just released)

9d. per yd.

BALANCED TWIN FEEDER per yd. 6d.
TWIN SCREENED COAXIAL FEEDER } 80 ohms
per yd. 1/-

80 OHM COAXIAL CABLE, 5d. per yd. ¼in. dia.

TRIMMERS. Ceramic, 50, 70 pf., 9d. 100 pf., 150 pf., 1/3; 250 pf., 1/6; 500 pf., 1/9.

RESISTORS.—All values 10 ohms to 10 meg., ½ w., 4d.; ¼ w., 6d.; 1 w., 8d.; 2 w., 1/-; High Stability, ½ w. 1%, 2/-. Preferred values 100 ohms to 10 Meg.

WIRE-WOUND RESISTORS.—Best Maker. Miniature Ceramic Type—5 w., 15 ohm to 4 K., 1/9; 10 w., 20 ohm to 6 K., 2/3; 15 w., 20 ohm to 10 K., 2/9; 5 w. Vitreous, 12 K. to 25 K., 3/-.

WIRE-WOUND POTS. 3 WATT FAMOUS MAKE.

Pre-Set Min. T.V. Type	Size Pots, 2½in. Spindle
Knurled Slotted Knob.	High Grade. All Values.
All values 25 ohms to 20 K., 3/- ea. 50 K., 4/-	100 ohms to 50 K., 5/6; 100 K., 6/6.
Ditto Carbon Track 50 K. to 2 Meg., 3/-. Standard	W/W EXT. SPEAKER CONTROL 10 Ω, 3/-.

O/P TRANSFORMERS.—Heavy Duty 70 ma., 4/6. Ditto Tapped primary, 4/9. Tapped small pentode, 2/9.

L.F. CHOKES, 10 h. 65 ma., 5/-, 20/25 h. 100/150 ma., 10/6, 5 h., 250 ma., 15/-; 15 h., 100 ma., 10/6. LYNE, 3 h. 250 ma., 13/6. SIMPLEX, 10 h. 150 ma., 10/6. MAINS TRANS.—Made in our own workshops to high grade specification. Fully inter-leaved and impregnated Tapped prim. 200 v./250 v., Heater Trans., 6.3 v., 1½ amp., 7/6; ditto 6.3 v., 3 amp., 10/6; ditto, 12 v., 2½ amp., 7/6; 350-0-350, 80 ma., 6.3 v., 4 a., 5 v., 2 a., ditto 300-0-300 ditto 250-0-250, 21/-. AMPLIFIER TRANS. 250 v. 50 ma. ½ wave, 6.3 v. 2 a. Fully Shrouded, 17/6. Television Auto Type, 35/-. Simplex, 35/-.

SOUNDMASTER SPECIALS.—Mains Trans., 35/-. L.F. Chokes, 10/6. O/P Trans., 5/6. Envelope, 6/6. Specified Wafer Switches, 22/6 per set of 3.

TAPE RECORDING BARGAIN

LIGHTWEIGHT XTAL HAND MIKES. Chrome finish—Quality and sensitivity for only 35/-.
ELECTRODYNAMIC MIKE INSERT.—G.E.C. make, precision engineered. Size only 1in. diam. by ¾in. Bargain Price 3/9. Matching Trans. 3/9.

COPPER PLATED AERIAL RODS. ¼in. × 15in. push fitting, 3/6 doz., P. & P. 9d.

TYANA.—Midget Soldering Iron. 220/250 v. or 230/250 v., 14/11. TYANA TRIPLE THREE.—Complete with detachable bench stand, 19/6.

NEW SOLON MIDGET IRON.—35 w., 19/6. IDEAL FOR RADIO CONSTRUCTORS.

C.R.T. HEATER ISOLATION TRANSFORMER.—Low leakage winding with 20% sec. boost. Ratio 1 : 1.39, 2 v., 10/6; 4 v., 10/6; 6.3 v., 10/6; 12 v., 10/6.

MIKE TRANSF.—Ratio 50 : 1, 3/9 ea., new and boxed.

V'HOLDERS.—Pax: Int. Oct., 4d.; RP20, EA50, 6d.; M12A CRT, 1/3. Moulded: Int. Oct. 6d.; B7G, 9d.; with screening can, 1/6; B5A, B8G, B9A, 1/-; VCR97, 2/6. Ceramic: RP20, B7G, 1/-, B3G, and AMER, 5-, 7- and 9-pin, etc., 1/-.

TAG STRIPS.—2- or 3-way, 2d.; 4- or 5-way, 3d.; 6-way, 4d.; 8- or 10-way, 6d. etc.

T/V PRE-AMP.—Channel 1. Easily modified for other Channels or Converter use. Midget Chassis, 4½ × 3½ × 1¼. Complete with EF42 valve, coaxial lead and plug. Ready for use. Brand New Mfrs. Surplus. Listed £3/15/-. Special Clearance Price, 27/6; p. & p. 1/6.

TOGGLE SWITCHES EX-GOVT.—" On-Off." 9d. Ersin M'cored solder 60/40, 16 g. or 18 g., 5/6 ½ lb., 9d. yd. T.C. wire, 18 to 22 s.w.g., 2/- per lb. P.V.C. Connecting wire, 10 colours. Single or Stranded 2d. yd. 2 K. 5 w. H.D. w/w Pots. 4/6. 10 K., 25 K., Colvern w/w Pot. 1in. spindle, 5/6.

SCREENED GRID CAPS 1. Oct. or Mazda 6d. ea. BULGIN

HIGH VOLTAGE VALVE CAPS, 1. Oct., 1/-.

FUSES.—1¼in. all values 60 ma. to 10 a., 9d.

ALADDIN FORMERS and cores, ¼in., 9d.; ⅜in. 10d.

SLOW MOTION DRIVE.—Epicyclic ratio 4 : 1, 2/3

INT. OCTAL CABLE PLUG (8-pin), with cover, 1/3.

200-250 Volt SELECTOR SOCKET (3in. × 1in.) with Plug 1/-. PILOT LAMPS.—6.3 v. .3 a., 9d.

EXT. L.S.—Switched Socket, on-off and parallel switching, complete with plug, 2/-.

MAINS DROPPERS. 3in. × 1¼in. Adj. sliders. .3 amp. 750 ohms, 4/9. .5 amp., 1,000 ohms, 4/3.

LINE CORD.—.3 amp., 60 ohms per foot, .5 amp. 100 ohms per foot, 2 way, 1/6 a yard; 3-way, 1/9 a yard.

Plessey
Multi Speed
Changer

PRICE Carriage Paid (TAX PAID) **£9 . 19 . 6**

GREAT REDUCTION

Brand New Plessey 3-speed Autochanger Mixer Unit for 7, 10 and 12in. Records. Twin Hi-Fi Xtal Head with Duospinel sapphire stylus. Plays 4,000 records sprung mounting. Superb Quality. Bargain.

★ MIXER TYPE MECHANISM
★ DUAL POINT TURNOVER HEAD

BARGAIN OFFERS

Nuts, Bolts and Washers, 12 of ea. 1/- packets, 2, 4 and 6 BA.

BATTERY CHARGERS. FULLY GUARANTEED. 200/250 v. Output 6 v. and 12 v. 1½ amps., in steel case complete with fuse and leads, ready for use. OUR OWN MAKE 35/-. Post 1/-.

WOODEN WALNUT CABINET.—12in. × 7in. × 5in. TRF or superhet, punched chassis, dial, back-plate, drive, pointer, etc., 29/6.

SUB MINIATURE VALVES
WIRE ENDS

★ R.F. Pent. .625 v. Fil.
● L.F. Pent. 1.25 v. Fil.

Brand New. Ex Deaf Aid Apparatus, by Mullard, Hivac and American. Types:—

★ XFW 10	● XFY11	
★ XFW 20	● XFY32	
★ 505 AX	● DL66	all at
★ DF96	● DL72	**7/6** each
★ DF70	● 503AX	post free
	● 507 AX	

VCR97 £2
TESTED FULL PICTURE
P. & P. 2/-.

CRYSTAL DIODE. — Very sensitive. G.E.C., 3/6. H.R. PHONES. — (Hi-grade Amer.), 15/6 pr. S. G. BROWN 2, 4,000 ohms, 15/6 pr.

RADIO COMPONENT SPECIALISTS

THO 1866. Nearer 133 or 68 pass door.
307 WHITEHORSE RD., WEST CROYDON
OPEN ALL DAY SATURDAY.
P. & P., 6d. £1 orders post free. Lists 2d.
ALL MAINS TRANS.—1/- extra postage.

PYE Aerial Plug and Socket, 1/6 pr.
Sin. RADIO SCREWDRIVERS.—Sheffield made blade 2½in. × ¼in. Ins. handle 3,000 v. 4½d. each.

CONDENSERS.—New stock .001 mfd. 6 kV. T.C.C. 5/6 Ditto 12.5 kV. 9/6; 2 pf. to 500 pf. Mica 6d.; .001 500 v. .01 Sprague 500 v. .02 500 v. .1 mfd. 350 v. Micramould 9d.; .05 mfd. and .1 mfd., 1/-; .25 mfd., 1/6; .1 mfd. HUNTS MOLDSEAL.—500 v., .005., .01 mfd., 9d. 600 v., 1/3; Tubular .5 mfd. 350 v., 1/9.

SILVER MICA CONDENSERS.—10%.
5 pf. to 500 pf., 1/-. 600 pf. to 3,000 pf., 1/3.

DITTO 1% (ex stock).
1.5 pf. to 500 pf., 1/9. 515 pf. to 1,000 pf., 2/-.

ELECTROLYTICS ALL TYPES NEW STOCK.

Tubular Wire ends		50/25 v.	1/9
8+16/500 v.	5/6	50/50 v.	2/-
16+16/500 v.	6/-	Can Types, Clips, 2d. ea.	
1/275 v.	2/-	32+32/350 v.	4/6
2/450 v.	2/3	32+32/275 v.	4/6
4/350 v.	1/6	16/450 v.	3/6
4/500 v.	2/-	32/350 v.	4/-
8/450 v.	2/3	60/350 v.	6/6
8/500 v.	2/9	250/350 v.	6/6
16/500 v.	2/6	8+16/450 v.	5/-
16/500 v.	4/-	8+16/500 v.	5/6
8+8/500 v.	4/6	16+16/450 v.	5/6
32/350 v.	4/-	16+16/500 v.	6/-
32/500 v.	5/-	16+32/350 v.	4/6
32+32/350 v.	5/6	32+32/450 v.	6/6
32+32/500 v.	7/6	60+100/350 v.	11/6
25/25 v.	1/6	200+200/275 v.	12/6

SPECIALS. Can Types. 500 mfd. 12 v., 3/-; 1,000 mfd. +1,000 mfd., 6 v., 6/6; 1,500 mfd. 6 v., 4/6; .1 mfd. 1.5 kV. T.C.C., 3/6.

SIEMENS RECTIFIERS. H.T. TYPE FLY-BACK VOLTAGES. K3/25 2 kV., 4/6; K3/40 3.2 kV., 6/-; K3/45, 3.6 kV., 6/6; K3/50 4 kV., 7/3; K3/100 8 kV., 12/6; K3/160 14 kV., 18/-. MAINS TYPE.—RM1, 125 v., 60 ma., 4/-; RM2, 100 ma., 4/9; RM3, 120 ma., 5/9; RM4 250 v. 275 ma., 16/-.

KNOBS, GOLD ENGRAVED.—Walnut or Ivory. 1¼in. diam., 1/6 each. " Focus," " Contrast," " Brilliant," " Brilliance—On-Off," " On-Off," " Volume" " Vol.—On-Off," " Tone," " Tuning," " Treble," " Bass," " Wavechange," " Radio-Gram," " R., M., L., Gram.," " Record-Play," " Brightness," Ditto not engraved, 1/- each.

POINTER KNOBS.—Brown with white marking line, small 9d., large 1/-.

COILS. — " P " type, 2/6 each. Midget " Q " Type adj. dust core, 3/6 each. All ranges.

REACTION COND.—.0001, .0003, .0005 mfd., 3/6 ea.

BANKRUPT STOCK

PEN TORCHES.—Drydex, chromium plated with vest pocket clip. Complete. New battery and bulb. Listed 5/6. Our Price 2/6.
HANDILITE.—Drydex, pocket or handbag flashlight. Complete. Battery and lens bulb. Listed 3/6. Our Price 2/6.

ALUMINIUM CHASSIS.—16 s.w.g. Plain, undrilled, folded 4 sides and riveted corners lattice fixing holes. Strong and soundly constructed with 2¼in. sides. 7in. × 4in., 4/6; 11in. × 7in., 6/9; 13in. × 8in., 8/6; 14in. × 11in., 10/6; and 18in. × 16in. × 3in., 16/6.

CHARGER TRANS. PRIM.—0/200/250 v. 8cn., 0-9 v.-15 v. (for charging 6 v. and 12 v.) 1.5 a., 13/6; 2 a., 16/-; 3 a. 19/6; 4 a., 21/-; 6 a., 30/-.

FULL WAVE BRIDGE SELENIUM RECTIFIERS.—6 or 12 v. 1½ amp., 8/9; 2 a., 11/3; 6 a., 23/6. Ditto F.W. only 6 v., 1 a. (9 v.-0-9 v. A.C.), 5/6.

ACID HYDROMETER.—New ex-Govt. Unbreakable. Packed in metal case, 7in. × 1¼in. dia., 4/6.

R.F. MIDGET CHOKES.—14 M.H., 2/6 each.

BRIMISTORS.—CZ1 for 2 a. heater chains, 2/6. CZ3 for .15 a., or .2 a., 2/6. CZ2, 1/6.

COPPER ENAMEL WIRE.—¼ lb. 14 to 20 s.w.g., 2/-; 22 to 28 s.w.g., 2/6; 30 to 40 s.w.g., 3/6.

SWITCH CLEANER Fluid, squirt spout, 3/9 tin.

TWIN GANG TUNING CONDENSERS.—.0005 mfd. midget with trimmers, 6/6; 275 pf. midget less trimmers, 6/6; .0005 Standard size with trimmers and feet, 6/-; less trimmers, 5/-; ditto, coiled, 2/6.

SLEEVING.—Various colours, 1, 2 mm., 2d.; 3, 4 mm., 3d. yd.; 6 mm., 5d. yd.

LOUDSPEAKERS P.M. 3 OHM. 8in. Plessey 12/6. Good mains 4in. square, 15/6. 5in. 14/6, 6½in., 16/-. 7in. Elliptical 15/6. 8in. R. & A. 17/6. 10in. R. & A., 25/-. 6½in. Plessey with trans., 7,000 ohms to 3, 19/6.

I. F. TRANSFORMERS

465 Kc/s Sine tuning Miniature Circular Can, 2½in. by 1¼in. diam. Pin octal V-holder cut out. High Q and good bandwidth. By Pye Radio. Two mounting feet.

BRAND NEW, 6/9 PAIR

RADIO · TELEVISION · HI-FI · ELECTRONICS · RECORDERS

LASKY'S RADIO

NOW IN STOCK! — THE NEW "LANE" TAPE TABLE MK.VI

Two speed, 7½in. and 3¾in./sec. Three high-grade motors. Record, playback, fast forward and fast rewind (under 1 minute). Takes standard reels up to 1,200 ft. capacity. Separate record and erase heads.

PRICE **£18.10**

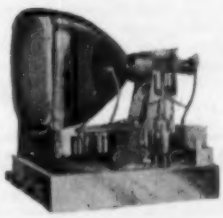
Carriage 3/6 extra. Available on H.P. terms.

CONVERT YOUR "VIEW MASTER" TO 14, 16 or 18 inch SCREEN

Wide Angle Conversion Kit using only W/B components as specified.

The Kit consisting of line trans., frame trans., scanning coils, width and linearity controls, focus magnet, ion trap, tube base, 1-K3/100, 1-K3/40, metal rectifiers, 1-6CD6, 1-6U4GT, 3 resistors, 9 condensers. THE COMPLETE PARCEL including valves and data book, Post and packing 3/6 extra. **£9.3.8**

"View Master" Wide Angle Conversion booklet and full details, 3/6 post free.



"SENTERCEL" SELENIUM RECTIFIERS

K3/10, 250 v.	2/6
K8/40, 3.2 kV	6/–
K3/45, 3.6 kV	8/2
K3/50, 4.0 kV	8/8
K3/100, 8.0 kV	14/8
K3/160, 12.8 kV	21/6
K3/200, 16 kV	26/–

"SENTERCEL" METAL RECTIFIERS

RM1, 125 v., 60 m/A	3/10
RM2, 125 v., 100 m/A	4/6
RM3, 125 v., 125 m/A	5/–
RM4, 250 v., 250 m/A	16/–

MAINS TRANSFORMERS

Special for MT1155, etc. Drop-through chassis mounting, half shrouded. 275-0-275 v., 110 m/A. 6.3 v. 4 amps., 5 v. 3 amps. **LASKY'S PRICE**, each 29/6

SPECIAL OFFER OF CONDENSERS

8 Mfd., 500 v.w., standard 1in. can. Limited quantity only. Each 1/2

BATTERY CHARGER KITS

200-250 v., A.C. mains transformer and metal rectifier.
No. 1, 6 v. at 1 amp 19/6
No. 2, 2, 6 and 12 v. at 1 amp 21/–
Post extra.

RECORDING TAPE

Every make and type stocked. Scotch Boy, E.M.I., Ferrovoice, Grundig, Ferrograph, Puretone, Gavert and Agfa etc.

★ THE MULLARD 10/12 AMPLIFIER KIT

All components, chassis and valves in stock. Available separately. **THE BOOK**, 2/6 post free.

★ THE OSRAM 912 AMPLIFIER KIT

All components in stock. Chassis, Partridge trans., chokes, W/B., etc. Available separately. **THE BOOK**, 3/6, post free.

INTERCOM. UNITS

4-station operation. For use on A.C./D.C. mains 200-250 volts. Complete, with 3 valves. Fitted in attractive plastic cabinet.

MASTER UNIT £5/19/6
Carriage 5/– extra.

Extension Units, price 21/– each complete. Carriage 2/– each extra.

PLESSEY AUTOMATIC RECORD CHANGERS

3-speed Mixer, crystal turn-over head. Brand new and unused in makers' original cartons. Limited quantity only. **LASKY'S PRICE** £9/19/6. Carriage 3/6 extra.

INEXPENSIVE RADIO YOU CAN BUILD

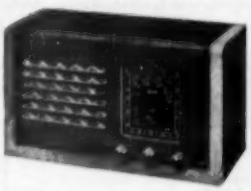
EVERY COMPONENT AND CABINET AVAILABLE SEPARATELY

THIS TRF 3-VALVE RECEIVER CAN BE BUILT FOR £5.10.0 *(Carr. & Pkg. 2/6 extra)*

Latest type circuit for 200/250 A.C. Mains, medium and long wave. Uses 6K7G, 6J7, 6V6, and Metal Rectifiers. Handsome Plastic Cabinet, 12 × 6½ × 5¼in. deep, Walnut or Ivory finish. If preferred a Wood Cabinet is available (see illus. below).

FULL DATA, wiring and circuit diagrams and price list of components, 1/– post free. **CABINET** only, plastic or wood, 17/6. Carr. & Pkg. 2/6 extra.

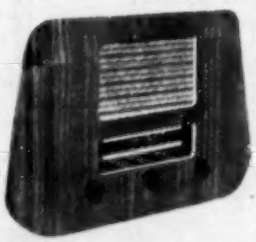
THIS 4-VALVE, 3-WAVE SUPERHET CAN BE BUILT FOR £7.19.6 *(Carr. & Pkg. 2/6 extra)*



Very efficient Superhet Circuit for 200/250 A.C. Mains, long, medium and short wavebands. Uses 6K8 freq. changer, 6K7 I.F. amp., 6Q7 det., A.V.C., AF-amp., and 6V6 output valves. Wood Cabinet, Walnut veneer, size 12 × 6½ × 5¼in. deep, or Plastic Cabinet as illus. above. **FULL DATA**, wiring and circuit diagrams and price list of components, 1/– post free. **CABINET** only, plastic or wood, 17/6. Carr. & Pkg. 2/6 extra.

THE "HARROW" BAFFLE RADIO CAN BE BUILT FOR LESS THAN £5.10.0

(Carr. & Pkg. 2/6 extra)



200/250 A.C. Mains, medium and long wave, using 2-6K7, 6V6 and 5Z4 valves. Note the attractive Baffle design Cabinet outside dim. 17½ × 11½ × 5in. deep, finished satin mahogany veneer. Easy to build and gives fine performance.

CIRCUIT DIAGRAM and price list of components, 1/– post free. **CABINET** only, 32/6. Carr. & Pkg. 2/– extra.

HIRE PURCHASE TERMS AVAILABLE

on certain items. Please give details of your requirements.

FAMOUS MAKER'S SURPLUS OF RECORD PLAYER CASES

Well made and covered lizard pattern rexine. Size 18½ × 13½ × 8½in. Will take Collaro auto-changer. An opportunity you should not miss.

LASKY'S PRICE 50/–
Carriage 3/6 extra.

LASKY'S T.V. CONSTRUCTORS' PARCELS

No. 1 WIDE ANGLE PARCEL.

Containing ferrocube line E.H.T. transformer, ferrocube scanning coils, frame output transformer, p.m. focus unit, frame blocking osc. transformer, 14-, 16- or 17-inch mask and glass, width and linearity controls. Also the following valves: 6U4gt, 6CD6, 6AL5, 2—6AM6 (N70), 2—12AU7. Full circuit.

LASKY'S PRICE COMPLETE £8/15/11
Carriage 3/6 extra

No. 2 WIDE ANGLE PARCEL

As No. 1 parcel but less valves
LASKY'S PRICE 94/11
Carriage 2/6 extra

No. 3

All brand new components by Ferranti. Comprises E.H.T. flyback line transformer, 7-10 Kv. with ferrocube core and rectifier heater winding; scanning coils; frame output transformer; line focus unit with vernier adjuster, U.25 E.H.T. rectifier, 17 in. mask and glass. **LASKY'S PRICE FOR THE COMPLETE PARCEL 79/6**
Carriage and packing 3/6 extra

No. 4 COMPLETE SET OF METALWORK

Unassembled. Comprising main chassis tube supports and valve holders. (Less sound-vision chassis.) **PRICE 25/–**
Carriage 2/6 extra

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

LASKY'S RADIO

SAVE POUNDS! ORDER BY POST IF YOU CANNOT CALL

★ ANOTHER BIG BARGAIN RADIOGRAM CHASSIS

5-valve superhet, 3 wavebands—long, medium, short. Latest type miniature valves, gram. switch, ext. speaker socket. Large full vision dial. Size 12 × 7 × 8in.

LASKY'S PRICE **£10.5.0**

Packing and Insurance 10/- extra.

BUILD THE "TELE-KING"

5 Channel 16 or 17 inch SUPERHET RECEIVER

This famous and well tried home constructor set can now be built for £29/10/-. Tube and cabinet extra.

EVERY COMPONENT CAN BE SUPPLIED SEPARATELY.

Full constructional data, wiring diagrams and circuits.

PRICE 6/- POST FREE

WRITE NOW FOR OUR NEW "TELE KING" PRICE LIST. WE CAN SAVE YOU MONEY.

MAINS TRANSFORMERS

All 200-250 v. 50 c.p.s. primary. Finest quality, fully guaranteed.

MBA/3. 350-0-350 v. 80 mA. 6.3 v. 4 a., 5 v. 2 a. Both filaments tapped at 4 volts. An ideal replacement trans. 18/-.

MBA/6. 325-0-325 v. 100 mA. 6.3 v. 3 a., 5 v. 2 a. With mains tapping board. Price 22/6.

MBA/7. 250-0-250 v. 80 mA. 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts. 18/-.

MBA/8. SPECIAL OFFER. Drop through type. 235-0-235 v. 60 mA. 6.3 v. 3 a. 12/6.

MBA/9. 400-0-400 v. 60 mA. 6.3 v. 1 a., 4 v. 2.5 a. Price 12/6.

AT/3. Auto transformer. 0-10-120, 200-230-240 volts 100 watts. Price 17/6.

HOUSE YOUR TV MAGNIFICENTLY IN ONE OF THESE SUPERB CABINETS!

THE DE-LUXE

Complete with mask, glass, castors, shelf, bearers, C.R.T. neck end protector, back, speaker fret and baffle board. Finished in beautiful figured medium, light or dark walnut veneer, with high polish. Suitable for most home constructor T.V. receivers, including the "Viewmaster," "Practical Television," "Tele-King," "Magniview," "Wireless World," etc. Can be supplied with cut-out for 14in., 16in. and 17in. C.R. tubes at no extra cost.

An allowance of 4/6 will be made if the mask is not required.
Inside Dimensions: Depth 16½in.; width 17¾in.; height 28in. Overall height 32in. and width 18½in.

WHY NOT CONVERT YOUR TABLE RECEIVER TO A CONSOLE MODEL? Adaptor frames for fitting 9in. or 10in. C.R. tubes available if required.

LASKY'S PRICE **£8/10/-**
Carriage 12/6 extra.

H.P. Terms. Deposit £2/17/- plus carriage. Balance plus charges spread over 12 mths.

THE ROTHESAY

The last word in outstanding contemporary design. Absolutely rigid construction throughout with the finest laminated woods, veneered in walnut, polished light, medium or dark shade. Fitted with gold anodised speaker grille. The C.R.T. aperture frame is detachable, supplied to suit any size tube to order. Full length doors if required can be spplied with the cabinet. Veneered both sides, polished to match the cabinet, and mounted with full length piano hinges.

NOTE THESE GENEROUS SIZES. Outside dim. 34½in. high, 21½in. wide, 21½in. deep. Inside dim. 18½in. wide, 19½in. deep. Size of top 22½in. × 21½in. Thickness ½in.

LASKY'S PRICE **£9/19/6**
Carriage 15/- extra.

H.P. TERMS. Deposit £3/10/- plus carriage charge. Balance plus charges spread over 12 months.

The Rothesay cabinet with doors. Price £14/9/6.

MANUFACTURERS' SURPLUS TV COMPONENT BARGAINS

WIDE ANGLE 38 mm.

Line E.H.T. trans., ferroxcube core. 9-10 kV. .. 25/-
Scanning Coils, low imp. line and frame 25/-
Frame Output Transformer 10/6
Scanning Coils low imp. line and frame 17/6
Frame blocking osc. transformer 4/6
Line Blocking osc. transformer, caslan cored .. 4/6
Focus Magnets Ferroxdure 25/-
P.M. Focus Magnets. Iron Cored 19/6
Duomag Focalisers 29/6
300 mA. Smoothing chokes 15/-
Electromagnetic focus coil, with combined scan coils 25/-

STANDARD 35 mm.

Line Output Transformers No. E.H.T. 12/6 Line Output Transformers 6-9 kV. E.H.T. and 6.3 v. winding. Ferrox-cube .. 19/6
Scanning coils. Low imp. line and frame 12/6
Scanning Coils. Low imp. line and frame, by Igranic 14/6
Line blocking oscillator transformer 4/6
Frame blocking oscillator transformer 4/6
Frame output transformer 7/6
Focus Magnets:
Without Vernier 12/6
With Vernier 17/6
Focus Coils. Electromagnetic 12/6
200 mA. Smoothing chokes 10/6

ION TRAPS. All types, 3/-.

ENERGISED SPEAKERS
8in. with O/T 600 ohm field, 15/6.
8in. less O/T 600 ohm field, 12/6.
8in. less O/T 1,200 ohm field, 12/6. 6½in. with O/T 600 ohm field, 14/-.

CLOSED FIELD SPEAKERS
6½in. 18/6
8in. round and 6½in. Elliptical 19/11.

P.M. LOUDSPEAKERS
2½in., 16/-. 5in., 18/6. 6½in., 16/6. 3in., 12/6. 8in., 18/6. 10in., 19/11.

Special Purchase! Super Bargain in

SPEAKER CABINETS

Attractive design finished in figured walnut veneer. Size 12½ × 8 × 4½in. Will take 6½in. speaker.

LASKY'S PRICE **17/11**
Post and packing 2/6 extra.

MOVING COIL MICROPHONES LESS THAN HALF USUAL PRICE!

By well-known manufacturer. Moving coil. Switch incorporated. Low impedance. Listed at £6/6/-.

LASKY'S PRICE **59/6**

MIKE TRANSFORMERS, 100-1 Each 1/11.

ELECTROLYTIC CONDENSERS ALL BRAND NEW

8 mfd. 450 v.w. 1/9
16 mfd. 350 v.w. 2/6
16 mfd. 500 v.w. 3/6
20 mfd. 500 v.w. 3/6
30 mfd. 450 v.w. 3/3
60 mfd. 350 v.w. 3/11
64 mfd. 450 v.w. 3/11
150 mfd. 350 v.w. 3/6
400 mfd. 150 v.w. 2/6
8 + 8 mfd. 450 v.w. 3/6
8 + 16 mfd. 450 v.w. .. 4/3
12 + 12 mfd. 350 v.w. .. 2/6
16 + 16 mfd. 350 v.w. .. 3/6
16 + 16 mfd. 450 v.w. .. 4/6
20 + 20 mfd. 275 v.w. .. 2/-
60 + 100 mfd. 350 v.w. .. 7/6
32 + 32 mfd. 450 v.w. .. 5/11
MANY OTHER SINGLE AND MULTIPLE CONDENSERS

HIGH VOLTAGE E.H.T. CONDENSERS

.1 + .1 mfd. 3.5 Kv. 5/11
.1 mfd. 7 Kv. 15/-
.001 mfd. 12.5 Kv. 7/6
.001 mfd. 15 Kv. 10/-
.0005 mfd. 10 Kv. 3/6
.0005 mfd. 15 Kv. 6/6
.04 mfd. 12.5 Kv. 5/-

C.R.T. Neck Protectors 2/6.

SPECIAL T.V. CONDENSERS

64 mfd. 450 v.w. 3/11
100 mfd. 450 v.w. 4/11
32 + 100 mfd. 450 v.w. .. 7/6
100 + 200 mfd. 350 v.w. 5/11

DENCO F.M. FEEDER UNIT All components and valves in stock Uses 6AM6, 12AH8, EB91, and two 6AB6. **THE COMPLETE PARCEL £6/7/6.** Post extra. All components available separately.

VALVES & C.R. TUBES. Over 25,000 in stock. Mullard, Brimar, Osram, G.E.C., Ferranti, etc.

METROSILS. 10 Kv. 5/-

BRIMISTORS. CZ.1 1/6 each. CZ.3 6d. each.

OUTPUT TRANSFORMERS

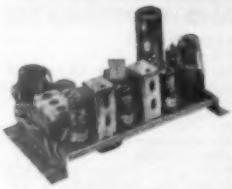
Midget Pentode 3/6
Miniature Personal, 3S4, etc. 3/6
Standard pentode 3/11
Push-Pull, 6V6 ..... 9/6
Multi Ratio, P.P. 12/6
Heavy Duty, P.P. 14/11

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

EVERYTHING FOR HOME CONSTRUCTOR & SERVICEMAN

LASKY'S RADIO

COMPLETE 5-VALVE RADIO CHASSIS



Completely wired and ready for use with the addition of a speaker and output transformer. Two controls: Volume and Station switch. Valves used: 10C1, 10F9 or UF41, 10LD11 or UBC41, 10P14, U404 or UY41.

LASKY'S PRICE, less valves, Post 3/6. **69/6**

Complete with valves, £5/19/6.

★ I.F. 465 kc/s.
★ A.V.C.
★ 4 watts output.
★ 3 Station Pre Set.
★ Frame aerial.
★ Fully aligned.
★ Chassis size only 10in. x 5¼in. Max. height 5¼in.

ANOTHER LASKY SUPER SCOOP!

THE SCOPHONY-BAIRD CINE "SOUNDMASTER" NEW & UNUSED A COMPLETE TAPE RECORDER—CAN ALSO BE USED AS A STRAIGHT AMPLIFIER

LIMITED NUMBER ONLY. Full operating instructions and circuit diagram supplied with each Recorder. Write for further details.

LIST PRICE 72 GNS.

Originally designed for connecting to a cine projector for synchronising sound to silent films, this superb equipment with the addition of a motor becomes a Complete Tape Recorder of 5 watts undistorted output, and it can also be used as a straight Amplifier. Two Inputs for use with Crystal Mike and radio or gram. Permanent magnet Erase. Amplifier uses five valves:—2-6SN7, 2-6V6, 1-5Z4. For 200/240 A.C. mains.

LASKY'S PRICE

£17.13.0

(Carriage 12/6 extra)

Comprising the "SOUNDMASTER" complete with 5 valves, cover incorporating 8in. Loud Speaker with 24ft. of cable, Spare Input Plug, one empty Tape Spool, Mains Lead. Dimensions: 13½ × 16 × 11in. Nett weight 32lbs.

ROTHERMEL CRYSTAL MIKE complete with lead and plug 25/- extra (Listed at 5 gns.)

ARMOUR PLATE GLASS
16in. Actual size 17¼in. × 15¼in. × ⅛in. 7/11
15in. Actual size 16¼in. × 13in. × ⅛in. 6/11
12in. Actual size 13in. × 10¼in. × ⅛in. 4/-
9in. Actual size 9in. × 8in. × ⅛in. 3/-

TRIPLEX DARK SCREEN FILTERS
14 × 12½ × ⅛in. 7/6
15½ × 13½ × ⅛in. 9/6
Postage and packing 5/- per piece extra. (This charge is necessary owing to extra packing required.)

PERSPEX IMPLOSION GUARDS, incorporating escutcheon and filter plate.
12in. 7/6
12in. de Luxe 15/-
16in. de Luxe 17/6

C.R.T. MASKS. Brand New LATEST ASPECT RATIO
9in. 7/-
10in. 7/6
12in. Rubber 15/-
12in. Old Ratio 9/6
12in. Escutcheon mask, with Perspex filter 12/6
14in. Rectangular 12/6
15in. Cream rubber 17/6
16in. Plastic, white 12/6
17in. Rectangular 15/-

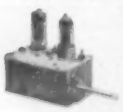
TELESCOPIC AERIAL MASTS
As previously advertised Complete. **LASKY'S PRICE** 25/-. Carriage 2/6 extra.

AERIAL ROD SECTIONS
Steel, heavily copper plated. 12in. long, ⅛in. diameter. Any number may be fitted together. 2/6 per doz. Post free.

SPECIAL TRANSFORMER
Secondary tapped as follows: 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volts at 2 amps. **PRICE 17/6.**

CRYSTAL DIODES
Glass type, wire ends. Each 1/6 Higher grades, 12 assorted for 30/-, post free.

CYLDON 5-CHANNEL SWITCHED TELETUNERS



Brand new. Instant and positive selection of any one of the 5 B.B.C. television channels, by a single control knob.
LASKY'S PRICE **12/6**
Post Free.
With valves **37/6.**

2-WATT MIDGET AC/DC AMPLIFIERS
PUSH PULL, VERY HIGH GAIN. 4 valves: 2 UL41 in push pull, 1 UCH42 and 1 UAF42. Input voltage 100/110 AC/DC. Very easily converted to 250 volts. Supplied with circuit diagram and full details. Size:—9 × 4 × 4 inches. Uses 2 metal rectifiers, 1 each RM2 and RM3. Ideal for ships record players, tape recorders, home record players, baby alarms, etc., etc. Supplied complete fully assembled and wired, with 4 valves.
LASKY'S PRICE 65/-, carriage free.

CO-AXIAL CABLE
75-80 ohms impedance.

Single Core, per yard,	5d.
Twin Core	1/-
Twin Balanced Feeder	6d.

CHOKES

40 m/a.	3/3	120 m/a.	7/3
60 m/a.	3/11	200 m/a.	12/6
80 m/a.	4/11	250 m/a.	14/-

DULCI RADIO CHASSIS
Full range stocked. 6 types to choose from.

ALUMINIUM CHASSIS. 18 S.W.G., undrilled, with 4 sides, reinforced corners. Depth 2¼in.

6 × 4in., 4/-	12 × 8in., 7/-	16 × 10in., 8/3
8 × 6in., 5/-	14 × 9in., 7/6	12 × 3in., 4/9
10 × 7in., 6/-	16 × 9in., 8/-	12 × 6in., 6/6

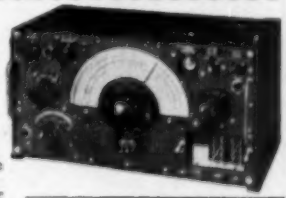
Post 1/- per chassis extra.

METAL RECTIFIERS
6 or 12 v.
F.W. Bridge.

2 amp.	11/3
4 amp.	15/-
6 amp.	23/6
1 amp.	6/6
10 amp. ..	32/6
½ amp., 6 v.	2/6
¼ amp., 12 v.	3/11
3 amp., 12 v.	12/6

R.1155 RECEIVERS

Now available on H.P. terms



5 Frequency ranges: 18.5-7.0 Mc/s; 7.5-3.0 Mc/s; 1,500-600 kc/s; 500-200 kc/s; 200-75 kc/s Supplied in maker's original wood transit case.
LASKY'S PRICE, brand new £11/19/6
Secondhand, Grade 1, ... £9/19/6
Secondhand, Grade 2, ... £7/19/6
Carriage 17/6 extra, including 10/- returnable on packing case.

ASSEMBLED POWER PACK/OUTPUT STAGE for R.1155 RECEIVER. For use on 200-250 v. A.C. Complete with 2 valves. In metal case, size 12 × 7 × 5¼in., 79/6. Carriage 5/- extra.

POWER PACK as above, fitted with 6½in. P.M. Speaker, £5/5/-. Carriage 5/- extra.

POSTAGE & PKG. CHARGES
(unless otherwise stated)
Orders value £1, 1/- extra.
Orders value £5, 2/- extra.
Orders value £10, 3/6 extra.
Over £10 carriage free.
All goods fully insured in transit.

LASKY'S RADIO

LASKY'S (HARROW RD.) LTD.

TWO ADDRESSES FOR PERSONAL CALLERS
Open all day Saturday. Early closing: Thursday.

370 HARROW ROAD, PADDINGTON, W.9.
(Opposite Paddington Hospital)
CUNningham 1979/7214.

42 TOTTENHAM COURT ROAD, W.1.
Between T.C.R. and Goodge St. Stns.
MUSeum 2605.

ALL MAIL ORDERS TO HARROW ROAD PLEASE

SELENIUM RECTIFIERS

L.T. Types

2/6 v. ½ a.h.w....	1/9
6/12 v. ½ a.h.w.	2/6

F.W. Bridge Types

6/12 v. 1 a.	4/11
6/12 v. 1.5 a. ...	7/9
6/12 v. 2 a.	9/6
6/12 v. 3 a.	12/3
6/12 v. 4 a.	14/9
6/12 v. 6 a.	18/9
6/12 v. 10 a.	28/6
24 v. 10 a.	57/6

H.T. Type H.W.

120 v. 40 mA. ...	3/11
250 v. 50 mA. ...	5/9
250 v. 80 mA. ...	7/9
250 v. 150 mA.	9/9
RM4 250 v. 250 mA.	11/9
260 v. 275 mA.	12/11

F.W. (Bridge Type)

250 v. 80 mA. ...	11/9

CO-AXIAL CABLE. 75 ohms ¼in., 7d yard. Twin screened feeder, 8d yd.

SILVER MICA CONDENSERS. 5, 10, 15, 20, 25, 30, 35, 50, 100, 120, 150, 180, 200, 230, 300, 330, 400, 470, 500, 1,000 pfd. (.001μF), .002 mfd. (2,000 pfd.). All at 5d. each, 3/9 dozen one type.

DIAL BULBS, M.E.S., 8 v. 0.15 a., 6/9 doz.; 6.5 v. 0.15 a., 6/9 doz.; 4.5 v. 0.3 a., 6/9 doz.

ELECTROLYTICS (Current production) NOT ex Govt.

Tubular Types

8μF 450 v.	1/11
8 mfd. 500 v. ...	2/6
16μF 350 v.	2/3
16μF 450 v.	2/6
16μF 500 v.	3/6
24μF 350 v.	3/3
32μF 250 v.	3/6
32 mfd. 500 v. ...	5/6
8-16μF 500 v. ...	4/11
25μF 25 v.	1/3
50μF 12 v.	1/3
50μF 50 v.	2/3

Can Types

8 mfd. 250 v. ...	1/3
8 mfd. 450 v. ...	2/3
8 mfd. 500 v. ...	2/6
16 mfd. 350 v. ...	1/11
16μF 450 v.	2/6
24μF 350 v.	2/11
32μF 250 v.	2/11
32 mfd. 450 v. ...	4/6
64 mfd. 450 v. ...	4/6
100 mfd. 450 v....	4/9
8-8μF 450 v.	3/11
8-8 mfd. 500 v. ...	4/6
8-16μF 450 v. ...	2/11
16-16μF 450 v. ...	4/11
16-32μF 350 v. ...	4/6
32-32μF 350 v. ...	4/6
32-32μF 450 v. ...	5/11

AMPLIFIER OR CHARGER CASES. Size 14½ × 5½ × 7½in. high. Strongly made in perforated steel. Grey enamel finish. Only 9/6.

VOLUME CONTROLS with long spindles, all values, less switch, 2/9; with S.P. switch, 3/9.

WIRE WOUND POTS: 20 ohms, 500 ohms, 5K, 20K, 50K, 100K (medium length spindles), 2/6. 220 ohms, 2K, 10K, 20K, Preset type, 1/9 each.

AMMETERS. Moving coil. G.E.C. 0-5 amps., 2in. scale, 11/9.

EX-GOVT. E.H.T. SMOOTHING CONDENSERS

.25 mfd., 4,000 v. Blocks.....	4/9
.5 mfd., 2,500 v. Blocks.....	3/6
.5 mfd., 3,500 v. Cans.....	3/3
.1 mfd. plus 1 mfd. 8,000 v., large blocks (common negative (isolated).....	9/6
1.5 mfd., 4,000 v. Blocks.....	5/9

EX-GOVT. ACCUMULATORS with non-spill vents. Unused and guaranteed. 2 v. 16 A.H., 5/9 each.

EX-GOVT. BLOCK PAPER CONDENSERS

2 mfd. 800 v.	1/9
4 mfd. 500 v.	2/9
4 mfd. 750 v.	3/9
4 mfd. 1,000 v....	4/3
4 mfd. 1,500 v. ...	4/9
4 mfd. 400 v. plus 2 mfd. 250 v..	1/11.
4 mfd. 1,000 v. ...	6/9
6-6 mfd. 450 v. ...	5/9
8 mfd. 500 v. ...	5/9
8-8 mfd. 500 v. ...	6/11
15 mfd. 500 v. ...	7/9
250 v. 80 mA. ...	11/9.

EX-GOVT. BLOCK ELECTROLYTICS. Small size 2,000 mfd. 12 v. for L.T. smoothing, 1/11 ea.

M.E. SPEAKERS. All 2-3 ohms, 8in. R.A. field, 600 ohms, 11/9. 10in. R.A. field, 1,500 ohms 23/9 10in. R.A. field, 1,000 ohms, 23/9. SPECIAL OFFER. Mains Trans. 200-250 v. 50 c/s. Primary. Secs. 300-0-300 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a., half shrouded drop through, 21/9.

HEAVY DUTY BATTERY CHARGER

For normal 200/250 v. A.C. mains input. To charge 12 v. battery. Variable charge rate of up to 10 amps. Fitted Meter and Fuses. Guaranteed 12 months. Carr. 7/6 66/19/6.

HEAVY DUTY BATTERY CHARGER KIT

For normal 200/250 v. A.C. mains. Comprises mains Transformer, 2 F.W. Metal Rectifiers, 2 variable resistors, 4 insulated terminals, 2 meters, 4 fuses and circuit. Total output 18 amps. Separate outputs for 6 v. and 12 v. Will make ideal Charger for Garages. Carriage 15/-. 59/19/6.

DRYDEX HANDLAMPS, suitable for garage lights, etc. (Normal price 29/6). Limited number. Brand new boxed, fitted with bulb, 19/6.

R.S.C. TRANSFORMERS

FULLY GUARANTEED, INTERLEAVED AND IMPREGNATED

MAINS TRANSFORMERS

Primaries 200-230-250 v. 50 c/s.

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250 v. 60 mA. 6.3 v. 2 a., 5 v. 2 a., Midget type, 2½-3-3in.	16/9
350-0-350 v. 70 mA., 6.3 v. 2 a. 5 v. 2a.....	18/9
250-0-250 v. 100 mA., 6.3 v.-6 v. 4 a., c.t., 0-4-5 v. 3 a.	23/9
250-0-250 v. 100 mA., 6.3 v. 4 a. 5 v. 3 a....	22/6
250-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., for R1355 conversion.....	29/6
300-0-300 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a....	22/9
300-0-300 v. 100 mA., 6.3 v.-4 v. 4 a. c.t., 0-4-5 v. 3 a.	23/9
350-0-350 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	22/9
350-0-350 v. 100 mA., 6.3 v.-4 v., 4 a. c.t., 0-4-5 v. 3 a.	23/9
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	31/6
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.	33/9
425-0-425 v. 200 mA., 6.3 v. 4 a., c.t., 6.3 v. 4 a., c.t., 5 v. 3 a., suitable Williamson Amplifier, etc.	47/9
450-0-450 v. 250 mA., 6.3 v. 6 a., 6.3 v. 6 a., 5 v. 3 a.	69/6

TOP SHROUDED DROP THROUGH TYPE

250-0-250 v. 70 mA., 6.3 v. 2.5 a.	12/11
260-0-260 v. 70 mA., 6.3 v. 2 a., 5 v. 2a.	15/9
350-0-350 v. 80 mA., 6.3 v. 2 a., 5 v. 2 a....	17/6
275-0-275 v. 80 mA., 6.3 v. 3 a., 4 v. 2.5 a.	14/11
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	21/9
300-0-300 v. 100 mA., 6.3 v.-4 v. 4 a., c.t., 0-4-5 v. 3 a.	21/9
350-0-350 v. 100 mA., 6.3 v. 4 a., c.t., 5 v. 3 a.	21/9
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.	29/11
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	26/9

E.H.T. TRANSFORMERS. 2,500 v. 5 mA., 2-0-2 v. 1.1 a., 2-0-2 v. 1.1 a., for VCR97, VCR517 ..... 38/6

FILAMENT TRANSFORMERS

Primaries 200-250 v. 50 c/s.

6.3 v. 1.5 a.	5/9
6.3 v. 3 a.	8/11
12 v. 1 a.	7/6
0-2-4-5-6.3 v. 4 a.	16/9
6.3 v. 2 a.	7/6
0-4-6.3 v. 2 a. ...	7/9
6.3 v. 6 a.	17/6
12 v. 8 a. or 24 v. 1.5 a.	17/6

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1½ a., 11/9; 0-9-15 v. 3 a., 16/9; 0-9-15 v. 4 a., 18/9; 0-9-15 v. 6 a., 22/9; 0-9-15 v. 15 a., 45/-.

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s. 120 v. 40 mA.	7/11
120 v. 40 mA., 5-0-5 v. 1 a.	14/9

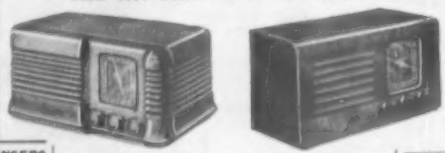
OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 2S4, etc.	3/6
Small Pentode, 5,000 Ω to 3Ω	3/9
Standard Pentode, 5,000Ω to 3Ω	4/9
Standard Pentode, 8,000Ω to 3Ω	4/9
Standard Pentode, 10,000 ohms to 3 ohms	4/9
Multi-ratio 40 mA. 30:1, 45:1, 60:1, 90:1, Class B Push-Pull	5/6
Push-Pull 8 Watts 6V6 to 3 ohms	8/9
Push-Pull 10-12 Watts 6V6 to 3Ω or 15Ω	15/9
Push-Pull 10-12 Watts to match 6V6 to 3-5-8 or 15Ω	16/9
Push-Pull 20 Watts high-quality sectionally wound 6L6, KT66, etc., to 3 or 15Ω	47/9

SMOOTHING CHOKES

250 mA., 3 H., 50 ohms	11/9
150 mA., 7-10 H. 250 ohms	11/9
100 mA., 10 H. 200 ohms	8/9
80 mA., 10 H. 350 ohms	5/6
60 mA. 10 H. 400 ohms	4/11
50 mA., 40 H. 1,000 ohms. Potted	10/9
20 mA., 30 H., 1,000 ohms	4/9

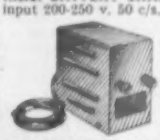
THE SKY CHIEF T.R.F. RECEIVER



A design of a 4-stage, 3-valve 200-250 v. A.C. Mains receiver with selenium rectifier. For inclusion in either of cabinets illustrated above. It consists of a variable Mu high gain H.F. stage followed by a low distortion grid detector triode. The next stage is a further triode amplifier with tone correction by negative feedback. Finally comes the output stage consisting of a parallel connected double triode giving ample output at an extraordinary low level of distortion. Point-to-point-wiring diagrams, instructions, and parts list, 2/6. This receiver can be built for a maximum of £4/19/6 including cabinet.

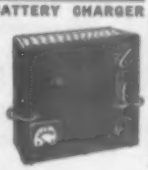
P.M. SPEAKERS. All 2-3 ohms. 6½in. Plessey, 16/9. 8in. Plessey, 15/9. 10in. R.A., 29/9. 10in. Plessey, 18/6. 10in. Rola with Trans., 29/6.

R.S.C. BATTERY CHARGER KITS. For mains input 200-250 v. 50 c/s. To charge 6 v. accumulator at 2 amps., 25/9. To charge 6 v. or 12 v. battery at 2 a., 37/6. To charge 6 v. or 12 v. battery at 4 a., 49/9. ABOVE KITS CONSIST OF BLACK CRACKLE LOUVRED STEEL CASE, MAINS TRANSFORMER, FULL WAVE METAL RECTIFIER, FUSES, FUSE-HOLDERS AND CIRCUIT. Any type assembled and tested for 6/9 extra.



R.S.C. 6 v. or 12 v. BATTERY CHARGER

For normal A.C. mains input 200-230-250 v., 50 c/s. Selector panel for 6 v. or 12 v. charging. Variable charge rate of up to 4 AMPS. Fused, and with 5 amp meter. Well ventilated metal case with attractive crackle finish. Guaranteed for 12 months, 69/6. Carr. 2/6.



EX-GOVT. MAINS TRANSFORMERS

All 230 v. 50 c/s. input

8.5 v. 4 a.	9/9
48 v. 1 a.	9/9
0-11-22 v. 15 a.	35/9
0-11-22 v. 30 a.	72/6
15-18-20 v. 35 a.	79/6
7.7 v. C.T. 7 amps 4 times	25/9
460 v. 200 mA., 6.3 v. 5 a.	27/9
365-0-365 v. 150 mA.	8/9
300-0-300 v. 80 mA. 5 v. 3 a.	8/11
278-0-278 v. 100 mA.	8/9
300-0-300 v. 150 mA., 610-0-610 v. 150 mA., 1,220 v. 250 mA.	29/9
40 v. C.T. 150 mA. 6 v. 6 a., 6.3 v. 6 a., 6.3 v. 0-6 a., 4 v. 6 a., 4 v. 3 a., 4 v. 2 a., 4 v. 3 a., 5 v. 2 a.	22/9

EX-GOVT AUTO. TRANSFORMERS

15-10-5-0-195-215-235 v. 500 watts	27/9
Double wound 10-0-200-220-240 v. to 10-0-275-295-315 v. 1,000 watts	69/6
Double wound 0-230 v. to 0-230 v. in steps of 11 volts from 57.5 5 KVA (21 amps)	69/15/-
Double wound 0-110-240 v. to 0-130-140-150-160-170 v. 1,500 watts	69/6

Carriage on any of above 5/- extra.

EX-GOVT. SMOOTHING CHOKES

250 mA., 10 H. 50 ohms	14/9
250 mA. 10 H. 100 ohms	14/9
250 mA. 3 H. 50 ohms	8/9
150 mA. 10 H. 50 ohms	10/11
100 mA. 10 H. 100 ohms, Tropicalised	8/9
100 mA. 5 H. 100 ohms, Tropicalised	3/11
50 mA. 50 H. 1,000 ohms. Potted	8/11
90/100 mA. 10 H. 100 ohms. Potted	8/9
50 mA. 5-10 H.	2/9
L.T. type 1 amp.	2/9

CHASSIS

18 s.w.g. undrilled aluminium amplifier type (4-sided).

12in. × 9in. × 2½in.	6/11
14in. × 9in. × 2½in.	6/11
14in. × 10in. × 3in.	7/11
16in. × 10in. × 3in.	8/3

18 s.w.g. aluminium receiver type.

6in. × 3½in. × 1½in.	1/11
7½in. × 4½in. × 2in.	2/9
10in. × 5½in. × 2in.	3/3
11in. × 6in. × 2½in.	3/11

16 s.w.g. aluminium, receiver type.

12in. × 8in. × 2½in.	5/3
16in. × 8in. × 2½in.	7/6
20in. × 8in. × 2½in.	8/11

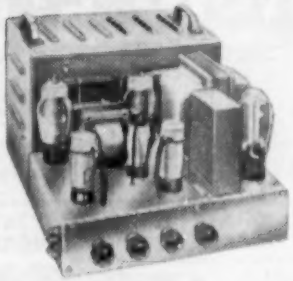
16 s.w.g. aluminium, amplifier type, 4-sided.

12in. × 8in. × 2½in.	7/11
16in. × 8in. × 2½in.	10/11
20in. × 8in. × 2½in.	13/6
14in. × 10in. × 3in.	13/6

R.S.C. HIGH FIDELITY 25 watt AMPLIFIER A 4

A NEW DESIGN FOR 1955

HIGH GAIN "PUSH PULL OUTPUT." BUILT-IN PRE-AMP. TONE CONTROL STAGES. INCLUDES 7 valves, sectionally wound output transformer, block paper reservoir condenser, and reliable small components. AN INPUT OF ONLY 20 millivolts IS REQUIRED FOR FULL OUTPUT. THIS MEANS THAT ANY TYPE OF MICROPHONE OR PICK-UP IS SUITABLE. Two separate inputs controlled by separate volume controls allow simultaneous use of "Mike" and Gram., or Tape and Radio, etc., etc. Individual controls for Bass and Treble "lift" and "cut." Six negative feedback loops giving total of 24 D.B. Frequency response ± 3 D.B. 30-20,000 c/s.



Hum level 66 D.B. down. Certified total harmonic distortion of only 0.35% measured at 10 watts. Comparable with the very best designs. SUITABLE FOR SMALL HOMES OR LARGE HALLS, CLUBS, GARDEN PARTIES, DANCE HALLS, etc., etc. For ELECTRONIC ORGAN OR GUITAR. For STANDARD OR LONG PLAYING RECORDS. Size approx. 12in. × 10in. × 9in. Weight 20 lb. Power consumption 175 watts. Outputs for 3 and 15 ohms speakers. The kit is complete in every detail. Chassis is fully punched. Easy to follow point-to-point wiring diagrams, are supplied. EXTRA HIGH SENSITIVITY, HIGHEST QUALITY for **9 Gns.** Or assembled ready for use **50/-** extra. **H.P. Terms now available on request.** Cover as illustrated if required, price **17/6** extra. plus carr. 7/6.

W.B. "STENTORIAN" High fidelity P.M. Speaker, HF1012, 10 watts, 15 ohm (or 3 ohm) speech coil. Where a really good quality speaker at a low price is required we highly recommend this unit with an amazing performance. **£3/13/6.**

MICROPHONES. Crystal, hand or Desk type, good quality Acos. **50/-.** Stand type with base and adjustable stand, **£6/13/6.** Both suitable for use with our amplifiers.

PLESSEY 3-SPEED MIXER AUTOCHANGERS with high impedance magnetic pick-up with dus point alloy stylus for long playing or standard records. (Will play 2,000 records before replacement stylus required.) Brand new, cartoned, guaranteed. Limited stocks at only **10 gns.**, plus 5/- carr.

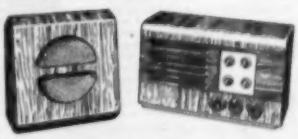
H.M.V. LONG PLAYING RECORD TURNTABLE COMPLETE WITH CRYSTAL PICK-UP (SAPPHIRE STYLUS). Speed 33⅓ r.p.m. BRAND NEW, CARTONED. Only **£5/19/6** (approx. half price). Carr. 5/-. (For 200-250 v. A.C. Mains).

R.S.C. 4-5 WATT HIGH GAIN AMPLIFIER TYPE A5

A highly sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high-fidelity pick-up heads, in addition to all other types of pick-ups and practically all mikes. Separate Bass and Treble controls are provided. These give full long playing record equalisation. Hum level is negligible being 71 D.B. down. 15 D.B. of negative feedback is used. H.T. of 300 v. 25 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape Deck preamplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate), with green crackle finish, and point-to-point wiring diagrams and instructions. Exceptional value at only **£4/15/-**, or assembled ready for use **25/-** extra, plus 3/6 carr.

A PUSH PULL 3-4 WATT HIGH-GAIN AMPLIFIER FOR £2/19/6

For mains input 200-230 v. 50 c/s. Complete kit of parts including point-to-point wiring diagrams and instructions. Amplifier can be used with any type of feeder unit or pick up. This is not A.C./D.C. with "live" chassis but A.C. only with 400-0-400 v. Trans. Output is for 2-3 ohm speaker. (We can supply a very suitable 10in. unit by Rola at **27/9.**) The amplifier can be supplied ready for use for **25/-** extra. Full descriptive leaflet, **9d.**



R.S.C. MASTER INTERCOMM. UNIT, with provision for up to 4 "Listen-Talk Back Units" individually switched. A high gain amplifier enables speech and other sounds emanating from the rooms containing remote control units to be heard at the master control. The unit is in kit form and point-to-point wiring diagrams are supplied. A walnut veneered wood or Brown Bakelite cabinet is included. Mains input is 200-250 v. 50 c/s. H.T. line 200 v. CHASSIS IS NOT "ALIVE." Ideal for use as "Baby Alarm" Sound amplification 4 watts. Price only **£5/19/6.** "Listen—Talk Back Unit" in bakelite or walnut veneered cabinet can be supplied at **35/-** each. Full descriptive leaflet **9d.** The Master Unit can be supplied assembled and tested for **30/-** extra.

PERSONAL SET BATTERY SUPERSEDER KIT.

All parts for an "All Dry" Battery Eliminator. Complete with case. For 4 valve receivers requiring 90 v. 10 mA. and 1.4 v. 250 mA. Fully smoothed. Outputs from normal 200-250 v. 50 c/s mains. Price with circuit, **35/9.** Or ready for use, **42/6.** Size of units 5½-4-11½in.

BATTERY SET CONVERTER KIT. All parts for converting any type of battery receiver to all mains. A.C. 200-250 v. 50 c/s. Kit will supply fully smoothed H.T. of 120 v, 90 v. or 60 v. at up to 40 mA., and fully smoothed L.T. of 2 v. at 0.4 a. to 1 a. Price complete with circuit and instructions only **48/9.** Supplied ready for use for **5/9** extra.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT with case, Mains input 200-250 v. Output 120 v. 40 mA. and 2 v. ½ a. Price with circuit, **29/6.** Or in working order, **37/6.**

R.S.C. A3 10 WATT "PUSH PULL" HIGH FIDELITY AMPLIFIER.

With Self Contained Pre-amplifier and Tone Control.

This amplifier, whilst having sufficient output to fill a small hall, is the ideal amplifier for the quality enthusiast who knows that though the average listening level is less than one watt it is necessary, for the very highest quality, to have an output of at least ten times this figure in order to obtain completely distortionless reproduction of sudden loud sounds.

The layout of the components has been planned to give the very maximum of performance with the minimum of constructional effort. Large safety factors in every component, A.C. and H.T. fuses, punched chassis with baseplate, screened input plugs, valves, and with easy-to-follow point-to-point wiring diagrams. The only things necessary to build this superb instrument are a soldering iron, screwdriver and pliers, everything else is supplied down to the last nut and bolt.

Two independent inputs are provided with two associated independent volume controls so that programmes can be mixed together if desired, such as microphone announcements superimposed on a musical programme, or two independently controlled microphones, or even just gramophone/radio, fading over from one to the other. Variable bass lift and cut with variable treble lift and cut tone controls are fitted, giving full long playing record equalisation for uncorrected pick-ups. They are also provided so that the user can alter the tonal values to suit his personal taste and surroundings. Because of the large negative feedback employed the output transformer can be so designed that it provides all the specified power even with large variations of loudspeaker impedance. Terminals are provided for 3 ohm and 15 ohm loudspeakers.

H.T. and L.T. available for the supply of a Radio Feeder Unit.

Six Negative Feedback Loops.
Max mum input for full output 150 millivolts.
Frequency response ± 3 DB 50-20,000 cycles.
Negligible hum and distortion.
For A.C. mains input 200/220/250 v. 50 c/s.

COMPLETE Kit of Parts **£7/19/6** (carriage 5/-).

Supplied assembled and tested for **45/-** extra.

H.P. TERMS AVAILABLE ON ASSEMBLED UNITS.

FOUR STAGE RADIO FEEDER UNIT.

Design of a HIGH FIDELITY, L. and M. wave T.R.F. Unit with self-contained heater supply and thorough H.T. decoupling. Only 250-0-250 v. 15-50 m.A. H.T. required from mains amplifier. Three valves and Low Distortion Germanium Diode Detector. Flat topped response characteristic. Loaded H.F. coils. Two variable Mu controlled H.F. stages, 2 gang condenser tuning. Cathode follower output stage. Switch position for Gram. and Gram. input and output sockets. Performance comparable with the best in Feeder Units. For A.C. mains 200-220-250 v. operation. Size 11-6-7½in. Illustration, full set of easy-to-follow wiring diagrams and instructions and individually priced parts list **2/6.** This unit can be built for only **£3/15/-**, including Dial and Drive Knobs and every item required.

Radio Supply Co. (LEEDS) LTD.

32 THE CALLS. — LEEDS, 2.

Terms C.W.O. or C.O.D. No C.O.D. under £1. Postage 1/- extra under 10/-, 1/6 extra under £2, 1/11 extra under £3. Full Price List 6d. Trade List 5d.
Open to Callers: 9 a.m. to 5-30 p.m. Saturdays until 1 p.m.

CLYNE RADIO LTD.

18, TOTTENHAM COURT ROAD, LONDON, W.1

MUSeum 5929/0095.

All goods specially selected for quality and value. Prompt Service—Money-back guarantee—It will pay you to visit our new rebuilt shop premises. Situated 50 yds. only from Tottenham Court Road Tube! (Genuine).

TAPE RECORDING EQUIPMENT. We can offer a well constructed cabinet handsomely finished in grey or brown resine made specifically to take Truvox and Wearite Tape Decks. Measures 22in. × 14in. × 9½in. deep. Completely portable, shows attractive speaker grille at one end, to take 8in. speaker. This cabinet is especially made to take in addition to the above decks, the very latest RECORD tape amplifier (RDA. V) at £16/16/-. Price of cabinet 79/6, plus P. and P.

N.B.—We can supply from stock the latest Truvox and Wearite Tape Decks at 22 guineas and £35 respectively. Reduction of 20/- on cabinet if purchased at the same time as either of these tape decks!

N.B.—We can also supply from stock the astounding Truvox Radio Jack. Overall length 4½in. × 3½in. × 2½in. Just plug into your tape recorder or any suitable amplifier to receive direct reception from any two local stations, or to make recordings (in the case of tape recorder) of any of the programmes radiated by the selected stations. Price only £3/8/4 tax paid, or send stamp for illustrated leaflet.

We also have in stock Elpico new tape deck at £19/19/-. Truvox Tape Amplifier type "G" at £16/16/- especially for use with Truvox Decks. Truvox Telephone adaptor at £2/2/-; also Dictation Attachment at £4/4/-.

SPECIAL PURCHASE. We can offer strictly limited supply of "Limpet" telephone tape recorder attachments. Simply stick rubber suction pad to base of telephone and plug into input-jack on your tape recorder. This automatically records incoming telephone conversation. Our price absolutely complete with lead and jack plug. 17/6 only, post free!

Manufacturer's surplus high-quality crystal microphone for hand or stand use. A few only at 50/-, post free. We can also offer a limited number of **Ronette Type EA crystal microphone inserts at 23/6.**

ROTHERMEL DA1 Crystal Microphone Inserts. Brand new, 7/6 each, plus 9d. P. & P.

METER SPECIAL! We have a limited quantity of aircraft electrical thermometers. Brand new, by Weston. 3in. moving coil meter, flush square fitting. These meters have a luminous scale graduated 40-140 degrees centigrade, but the full scale deflection is approximately 150 m/camp. Price 12/6 each only, plus 1/- P. & P.

VIBRATOR PACK. Brand new, by Mallory. 12 volt input, 150 v. 60 mA. output. Complete with synchronous vibrator 27/6. Fully assembled Power Pack and output stage, to plug straight into R1155 for A.C. 200/250 volts at 70/6. We have a few brand new R1155A at £11/19/6, also in original packing cases—Bonus of 10/- purchasing either receiver together with power pack. Plus 10/- packing and carriage.

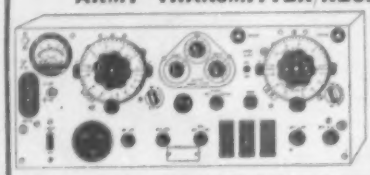
R1194 RECEIVER UNIT. Coverage 50-40 Mc/s. Including 6 valves—3 type 9D2, 1 each, 8D2, 15D3 and 4D1—6in valve-screening cans, 24 ceramic trimmers, 6 ceramic valve holders, resistors, condensers, I.F.T.'s coils, etc. In very good condition, a bargain at 19/6 each only, plus 2/6 packing and postage.

RECEIVER TYPE 85/73. (The receiver section of T.R.1196). Supplied complete with full data for conversion to 5-wave-superhet receiver. Unit is complete with 6 valves 3-SP39, 2-SP36, PK32 and EBC33, also standard I.F.T.'s 465 Kc/s. Price 27/6 plus 2/6 P. & P.

TR1196 TRANSMITTER PORTION. We can also supply the transmitter portion of the above receiver incorporating valves, RL37, RP30, CV301, Type 603 relay, transformer, coils, switches, etc. Limited quantity at 12/6 only, plus 2/6 P. & P.

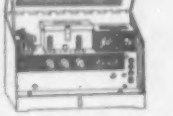
24 VOLT ROTARY CONVERTER. Input 24 v. D.C. Output 200/250 v. A.C. 100 watts. Complete in black steel box 18½in. × 11½in. × 8½in. Weight approx. 30 lb. Completely smoothed. Incorporates Sodium Lamp transformer. Brand new, 92/6.

SPECIAL PURCHASE OF EX-NEW ZEALAND ARMY TRANSMITTER/RECEIVERS.



TYPE 2621 MK. II.—Built into substantial steel cabinet mounted on easily removable resilient mountings. The instrument is fully tropicalised. Two wavebands, 2-4 Mc/s (75-150 metres) 4-8 Mc/s. (37.5-75 metres) switching by means of band switches. Transmitter output up to 2 watts depending on type of aerial used, gives ranges up to 35 miles on morse and 30 miles speech, in average country. Considerably greater ranges may be obtained by the use of horizontal aerials. H.T. is supplied by a built-in vibrator pack, requiring 12 volt input. Valve line-up, 2-6V6GT, 7-6U7G, 6K8G and 6Q7GT. 465 Kc/s. I.F.T.'s. Set weighs 58½ lb. Measurements 22½in. × 10½in. × 10in. These units are brand new, and price is £6/19/6 only, plus 10/- packing and carriage. This price includes fully illustrated 60 page instruction booklet including full circuit diagrams, suggested aerials, fault-finding etc. An unrepeatable bargain!!

REMOTE CONTROL UNITS



These units originally intended for use with the above transmitter/receiver, when inter-connected can be used as ordinary telephones or for practice morse-working one-to-one. Complete in handsome steel case, can be operated by ordinary torch battery. Has built-in morse key and buzzer unit. Price for each is 15/-. Suitable headphones can be supplied at 7/6 plus 5/- for carbon hand microphone. The whole plus 2/6 P. & P. Each unit includes full operating instructions—and is brand new.

N.B. Certain other spares are available and your specific enquiries will receive our very prompt attention.

F.S.D.	Size	Type	METERS Fitting	Price
50 microamp	D.C. 2in.	M.C.	F.B.	50/-
100 microamp	D.C. 2½in.	M.C.	F.B.	45/-
500 microamp	D.C. 2in.	M.C.	R.P.	15/6
500 microamp	D.C. 2½in.	M.C.	F.B.	18/6
1 mA.	D.C. 2in.	M.C.	F. Sq.	17/6
1 mA.	D.C. 2in.	M.C..	F. Sq. (scale calib. 1.5 kV.)	15/-
1 mA.	D.C. 2½in.	M.C.	F.B.	22/6
1 mA.	D.C. 2½in.	M.C.	Desk Type	27/6
5 mA.	D.C. 2in.	M.C.	F. Sq.	7/6
10 mA.	D.C. 2½in.	M.C.	R.P.	8/-
10 mA.	D.C. 2½in.	M.C.	F.B.	10/-
15 mA.	D.C. 2in.	M.C.	F.B.	7/6
20 mA.	D.C. 2in.	M.C.	F.B.	7/6
50 mA.	D.C. 2in.	M.C.	F. Sq.	8/6
150 mA.	D.C. 2in.	M.C.	F. Sq.	7/6
200 mA.	D.C. 2½in.	M.C.	R.P.	10/-
1 amp.	R.F. 2½in.	Thermo	R.P.	10/-
3 amp.	R.F. 2in.	Thermo	F. Sq.	9/-
6 amp.	R.F. 2½in.	Thermo	F.B.	7/6
20 amp.	D.C. 2in.	—	R.P. (with shunt)	10/6
25 amp.	D.C. 2½in.	M.I.	F.B.	6/6
30 amp.	D.C. 2½in.	M.I.	F.B.	12/6
15 volt	A.C. 2½in.	M.C.	F.B.	10/-
20 volt amp.	D.C. 2in.	M.C.	F. Sq.	7/6
15-0-15 volt	D.C. 2½in.	M.C.	F.B.	17/6
150 volt	D.C. 2in.	M.C.	F.B.	15/-

R.P. = Round projection. M.C. = Moving Coil. Thermo = Thermo-couple.
F. Sq. = Flush Square. F.B. = Flush Round. M.I. = Moving Iron.

METER RECTIFIERS. 1 mA. by G.E.C., at 8/6, also 5 mA. by Westinghouse at 8/6.

NZ-W.D. CATHODE RAY TUBES. Guaranteed full picture, VCR97 at 40/-. VCR517C at 25/-. Also VCR139A—ideal for oscilloscope 2½in. screen at 35/-. We also have VCR97 with slight cut-off, very suitable for oscilloscope, testing purposes, etc., at 15/- only. All these tubes are brand new, in original packing, and tested before despatch. Please add 2/6 packing and carriage for any of the above tubes.

AMERICAN TRIPLETT MULTI-RANGE TESTMETER. Housed in strong wooden case with carrying handle. Case size 10in. × 6½in. × 6in. deep. Meter 4in. rectangular type, with 50 microamp basic movement. Knife-edge needle. Incorporating the following ranges. 0-6000 volt D.C. 7 ranges. 20,000 ohms per volt. 0-6000 volt D.C. 7 ranges 1000 ohms per volt 0-6000 volts A.C. 7 ranges, 1000 ohms per volt. 0-15 amps. D.C. 7 ranges. 0-60 megohm resistance, 3 ranges. −15 to +7 decibels, 7 ranges. 0-6000 v. output meter. 7 ranges, 1000 ohms per volt. Each instrument is in nearly new condition, has been thoroughly overhauled, and is supplied ready working, complete with battery and test prods. Price £11/19/6 plus 5/6 p. & p. H.P. Terms available.

TRIPLETT RECTANGULAR METER. 4in. scale. Knife-edge needle. Basic movement 0-100 micro-amps. At present graduated for multi-range meter. Brand new in sealed cartons. 90/- plus 5/- p. & p.

STOP PRESS!!!

2½" ROUND FLUSH MOUNTING METER by WESTON, blank scale ready for re-engraving, FSD 650 micro-amps, brand new 27/6 only.

HIRE PURCHASE

We are pleased to announce advantageous hire purchase facilities on any single item over £5. Ask for details, mentioning what you are interested in.

28 SET POWER UNIT No. 4MK1 ZA10478.—Complete with 4 metal rectifiers each 250 v. 60 mA. 0-12 v. 4 pin Mallory Vibrators, transformers, condensers, resistors, signal 1 amp. indicator, etc., etc., in good condition. Complete in metal box size 10½in. × 6in. × 8in. Weight 19lb., 27/6, plus 5/-. P. & P.

VALVES. We have a very comprehensive stock of special purpose surplus valves at competitive prices. A stamp will bring Valve Price List.

L.T. RECTIFIERS TYPE R.K. A newly manufactured range guaranteed 12 months.

6 or 12 v. 1 a. F.W. bridge type	7/6
6 or 12 v. 1.5 a. F.W. bridge type ..	9/6
6 or 12 v. 2 a. F.W. bridge type	11/6
6 or 12 v. 4 a. F.W. bridge type	15/-
6 or 12 v. 6 a. F.W. bridge type	19/6

CHARGER TRANSFORMERS. Input 250 v.

6/12 v. 1 a.	9/9
6/12 v. 2 a.	11/9
6/12 v. 4 a.	17/6
6/12 v. 6 a.	25/-

STEEL INSTRUMENT BOXES!!!

Crackle finished in Brown or Black. Complete with chassis and insulated front panel. Measures 9½in. × 7½in. × 6½in. at 7/6, plus 3/6 P. & P.

BRAND NEW C.R. TUBES.—By leading manufacturer. 14KP4A. Latest type 14in. rectangular 6.3 v. heater. 12-14 Kv. in original sealed cartons. Limited quantity only at £13/19/6. SORRY! PERSONAL CALLERS ONLY!!!

AMERICAN INDICATOR UNIT TYPE BC929A. Brand new incorporating 3in. tube 3BP1, with mu-metal shield, 2-6SN7GT, 2-6H6GT, 6X5G, 2X2, 6G6G, 9 potentiometers 24 v. aerial switch motor, transformer, and a host of small components. The whole unit which measures only 8½in. × 6½in. × 12½in. is brand new, enclosed in black cracle box, and can be supplied at 65/- plus 5/- p. & p.

6-VOLT VIBRATOR PACK. Ex-W.D. 6-volt input, output 140 v. 30 mA. Fully smoothed and rectified, incorporating Wearite 6 volt 4 pin vibrator type NS86. Unit size only 6½in. × 5in. × 3½in. Price 15/- plus 1/6 P. & P. New condition.

POWER PACK TYPE 391. For 200/250 v. A.C. 50 cycle. Black case size 8½in. × 6½in. × 4½in. Outputs 250 v. at 80 m.A., 6.3 v. at 2.5 amps., 6.3 v. at .6 amp. (for 6X5), 21 v. at .3 amps. Could be adapted for R1155, etc. Price, complete, 27/6 only plus 2/6 P. & P. A Bargain.

R.F. UNITS. All new condition and complete in case 9½in. × 7½in. × 5in.

Type 24.—20-30 Mc/s. 15/-. Switched Tuning. **Type 25.**—40-50 Mc/s. 19/6. Switched Tuning. **Type 27.**—65-86 Mc/s. 45/-. Variable Tuning. **Type 28.**—50-65 Mc/s. Variable Tuning. 35/-. We have a limited supply of R.F.27 new condition and complete, but tuning dial damaged. Price only 30/- each. ALL these units Post Free!!

TEST METER—EX ARMY. Direct readings 15 v. and 3 v. D.C., 6 mA. and 60 mA. D.C. current, 500 ohms and 5,000 ohms resistance ranges. Complete in bakelite case with web carrying strap. 19/6 plus 1/6 P. & P.

T1154 TRANSMITTER UNIT. Medium/high-powered for C.W. or M.C.W. R/T 8 ranges, 16-5.5 Mc/s, 5-3.2 Mc/s, 500-200 Kc/s. Absolutely complete; 4 valves, 2 meters, hundreds of resistors, condensers, etc., in wooden transit case. Price 39/6, plus 7/6 carriage and packing.

BATTERY CHARGER 6/12 v. 4 A. Attractive grey and red metal case. Fused in and out. Full charge or half charge. Complete with heavy duty crocodile clips. Not Ex-Govt. Fully guaranteed. £4/19/6.

HEADPHONES. Brand new, ex-Govt., by S. G. Brown. Type CLR. Low resistance, 7/6 per pair. Type CBR high resistance, 12/6 per pair. We can also supply very special brand new American ex-Govt. lightweight high resistance phones by Trimm at 15/- per pair.

CO-AXIAL CABLE. Standard 80 ohms. brown, stranded centre, conductor, 6d. per yard only! Not Govt. surplus. Min. 12 yds.

"VOLTALYTE" 2 volt 80 amp. ACCUMULATORS MULTI-PLATE Type in celluloid containers. Size 3in. × 8in. × 6½in. high at 9/6 each plus 2/- P. & P. Or 2 for 28/6, post free.

BRANDENBURG E.H.T. UNITS. 6-9 kV., 6 cms.; 13-16 kV., 9 cms.; 6-9 kV. coil, 39/-; 10-15 kV. coil, 55/-. Wiring diagram supplied.

No. 22 TRANSMITTER/RECEIVER. WALKIE-TALKIE. Range approx. 5 miles. Coverage 7.4-9 mc/s. The set only, complete with valves at 20/-, in very good condition.

Please add postage under £1. C.O.D. or Cash with order. C.O.D. charge extra—open 9 a.m.–6 p.m. Monday to Friday. Sorry but we close at 1.0 p.m. on Saturday.

UNITELEX GENERAL PURPOSE AMPLIFIER MG4 AND MG4A.

For Gramophone and Microphone. Also very suitable for electric guitars and all types of electronic musical instruments. Maximum output 5 watts. Negative feedback employed, low signal-to-noise ratio. Matching to 3 or 15 ohm speakers. Separate treble and bass controls. Valve line-up ECC83, EL84 and E 88. Overall dimensions: 11½in. × 4½in. × 5½in. high. Wgt.: 8lb. Chassis finish is a hard and durable polychromatic stove-enamel. For A.C. mains 200/250 v. Price **£8/18/6.** Type MG4A is the same Amplifier but with cover and plastic baseplate, at **£9/19/6.** Both plus 3/- p. & p. Illustrated leaflet available. We have in stock the very latest "Elrico" Feeder Unit type RF720. Superhet for L., M., Short and Trawler Bands. Very attractive illuminated black and gold dial for immediate use with any amplifier. **15 gns.** tax paid.

HIRE PURCHASE

We are pleased to announce advantageous hire purchase facilities on any single item over £5. Ask for details, mentioning what you are interested in.

LATEST 3-SPEED AUTO-CHANGER, long arm model complete with C. and D. high fidelity heads. Limited quantity at **£17/10/-** plus 5/- P. & P. H.P. terms available.

ANOTHER GRAM UNIT BARGAIN! Collaro RC/631—6 record auto-changer for 78 r.p.m. Brand new complete with separate plug-in magnetic head. Our price **£5/5/-** only, plus 5/- p. & p.
Collaro AC/514—Single record playing units for 78 r.p.m. Brand new in sealed cartons, with separate plug-in magnetic head. Our price **£4/12/6** plus 3/- p. & p.

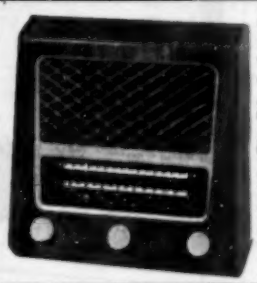
"CONTEMPORARY." A well-made Cabinet in light wood, made especially to blend with this type of furniture. The motor board is uncut, and will accommodate most Radio Chassis and Auto-change units. Size: 30in. × 15in. × 29in. high. Price **£8/15/-,** plus 10/- post and packing.

DECCA LIGHTWEIGHT PICKUPS. Complete with either standard or L.P. Crystal Cartridge inserts. Compl te with Rest and Tracking instructions, **33/6** plus 1/6 P. & P. Also their very latest type, as above, but with turn-over head **47/6** only! Plus 1/6 P. & P.

Carrying cases in black leatherette finish. An extremely well-made case with chrome locks and corner pieces for extra strength. This cabinet will house any 12in. Hi-Fi speaker, but can be put to a number of uses. Front panel and lid are removable, and the cabinet is packed in a strong cardboard container for carrying purposes. Size: 18½in. × 10½in. × 16½in. high. **55/-,** plus 5/- post and packing.

F.M.!! (Frequency Modulation)

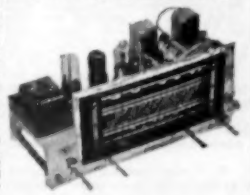
We are pleased to announce our complete Kit for the "Dence" F.M. Feeder Unit. This unit provides an A.F. output suitable for feeding into the audio section of a standard broadcast receiver where triode/pentode output are available. Within an average of 50 miles from a V.H.F. transmitter one I.F. stage should be adequate, but our complete Kit supplied includes all components and valves for an extra I.F. stage if necessary, or if the unit is used at greater distances. Full Constructional details, theoretical circuit and point-to-point wiring diagram can be supplied for 1/6 post free, or the complete Kit right down to the last nut and bolt, at only £6/7/6, plus 2/6 packing and postage. This unit can be supplied if desired, ready assembled, aligned and tested, at £9/10/-, plus 2/6 packing and postage.
If required we shall be pleased to align this unit for constructors not possessing the necessary equipment, for a charge of 7/6. N.B.—Valve line-up is 6AM8, 12AH8, 2-6BA6 and 6AL5. Chassis measures only 6½ × 5½ × 1½in. Demonstrations at 18, Tottenham Court Road!!



THE "SUPERIOR" FOUR KIT. Our new four-valve receiver. A.C. mains, 200/250 v. M. and Long Waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2 6BA7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size, 10½in. × 16in. wide. Maximum depth at base, 9in., tapering to 3½in. at top. Sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, **£8/9/6!!!** Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring and knobs, at **45/-,** plus 2/6 packing and carriage.
N.B.—Our Kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7 I.F. Amplifier, 6Q7 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 volts. 4 watts output. Excellent quality. High sensitivity. Provision for gram. Attractive illuminated black, red, green and gold dial for horizontal tuning. Four controls are: Tuning, L/M/S/Gram. Vol./on/off, Tone (variable). Chassis size: 12½in. × 8½in. × 2½in. Dial size: 10in. × 4½in. Assembly is simplified by the use of a 3-waveband coil pack, and pre-aligned 465 *Kcs.* I.F. transformers—high-grade drop-through half-shrouded Mains Transformer, with voltage adjuster panel. This chassis can easily be assembled in one evening. Illustrated pamphlet with full assembly instructions, practical and theoretical wiring diagrams and itemised price list, **1/6,** post free. The main items for this receiver can be supplied separately, as under. Drilled chassis, complete with valve-holders, A/E panel, P/U panel, tuning condenser and ready-assembled dial and drive at **30/6.** 3 waveband coil pack with gram position, **39/6.** Pair of 465 *Kcs.* I.F. Transformers, **9/6** pair. Half shrouded drop through Mains Transformer, **23/6.** The total cost of ALL items purchased separately is nearly £10, but we shall be pleased to supply all the required components right down to the last nut and bolt, at a special inclusive price of **£8/8/-,** plus 2/6 packing and postage. A set of four small brown and cream engraved knobs to suit is available at 1/3 each knob. This chassis is a professional job in every respect and can be seen and heard at our premises. This chassis can also be supplied, ready assembled, in very limited quantities at **£9/19/6,** plus 5/- carriage and packing.



THE "ECONOMY FOUR" T.R.F. KIT

A three valve plus metal rectifier receiver. A.C. mains 200/250 v. Medium and Long waves. We can supply all required components right down to the last nut and bolt. Valve line-up, 6K7, 6Q7, and 6V6. Chassis ready drilled—Cabinet size 12in. long by 6in. high by 5in. deep—Choice of ivory or brown bakelite, or wooden, walnut finish cabinet. Complete instruction booklet with practical and theoretical diagram. Each component brand new and tested prior to packing. Our price **£5/10/-** complete—Remember this set is being demonstrated at our shop premises! We proudly claim that our fully illustrated instruction booklet is the most comprehensive available for this type of receiver—Booklet available at **1/6** post free. This is allowed if kit is purchased later—Please, 2/6 packing and carriage for complete kit.

DULCI RADIO/RADIOGRAM CHASSIS

This very popular range of superior chassis can be supplied from stock. We will gladly demonstrate any to personal callers. All incorporate latest type valves 6BE6, 6BA6, etc. Flywheel tuning, negative feedback over entire audio section. Engraved knobs—3 tone position for Radio and Gram. All are built on chassis size 11½in. × 7in. × 8½in. high. All A.C. 160/110 and 200/250 v.—Dial size 9½in. × 4½in. for horizontal tuning. Attractive appearance.
Model R.3. Long, Medium, Short Waves (5 valves). Cash Price **£12/12/-.** H.P. Terms **£5/4/-** deposit, 12 months at **17/8.**
Model R.3 Plus Push Pull Stage. (6 valves). Cash Price **£15/15/-.** H.P. Terms, **£3/19/-** deposit, 12 months at **£1/2/2.**
Model R.3 Double Feature Push Pull and R.F. Stage (7 valves). Cash Price **£18/18/-.** H.P. Terms **£4/15/-** deposit, 12 months at **£1/6/9.**
Model R.4. (Medium, Long and Four Short Wavebands, Bandspread.) Cash Price **£15/15/-.** H.P. Terms **£3/19/-** deposit, 12 months at **£1/0/2.**
Model R.4, plus Push Pull Stage (6 valves). Cash Price **£18/18/-.** H.P. Terms **£4/13/-** deposit, 12 months at **£1/6/9.**
Model R.4 Double Feature Push Pull Plus R.F. Stage (7 valves). Cash Price **22 gns.** H.P. Terms **£5/15/6** deposit, 12 months at **£1/12/6.**
All chassis fully guaranteed 12 months. Please include 7/6 packing, carriage and insurance. Illustrated leaflet available. Suitable speakers available. Ask for speaker list.

THE R.C. RAMBLER ALL-DRY PORTABLE KIT

Full assembly details with practical and theoretical diagrams can be supplied at 1/6 post free. This is a truly professional 4-valve superhet—all dry—for medium and long waves. A cream plastic top panel, with dial engraved in red and green, adds to the very imposing appearance of this model which is housed in an attractive cream and gray leatherette covered attache-case type cabinet, measuring only 9in. × 7½in. × 8½in. Weight (less batteries 4½lb., with batteries 6½lb. This set really has everything! Built-in frame aerial, high quality, extremely sensitive, and very adequate volume from the 5in. speaker. Valve line-up: 3V4, 1S5, 1S5, 1T4. Also the required components, exactly as specified, including cabinet, can be supplied from stock at the special inclusive price of **£7/7/-** plus 2/6 P. & P. (less batteries). Uses Ever-Ready 90 v. H.T. type B198 at 9/3. Also L.T. 1.5 v. A.D.35 at 1/4.

RAMBLER MAINS UNIT!—At last we are able to o. er our special mains units kit for using our popular all-dry "Rambler" on A.C. Mains. Complete kit, which when assembled fits snugly into battery compartment, can be supplied at 47/6, plus 1/6 packing and postage. Price includes all required components, and full assembly instructions.

THE R.E.P. ONE-VALVE BATTERY RECEIVER KIT. Simple one-valve all-dry battery receiver for headphones, easily built in one evening. All required components including headphones, can be supplied at inclusive cost of **42/-** plus 2/- p. & p. Operated by Ever-Ready B114 type battery available at **7/6.** Full assembly details available separately at 9d. plus 2d. post.
THE NEW R.C. HIGH-FIDELITY AMPLIFIER. P.P. 6V6 output. Freq. 25—18,000 cps.—60db at 6½ watts. Treble boost and cut—Bass boost—L.P. correction. Provision for Feeder Unit Mar. UNDISTORTED OUTPUT 9½ watts. Price **14 gns.** plus 7/6. **NOW AVAILABLE**—Kit of Parts, complete with fully illustrated instructions **£11/19/6,** plus 5/- carriage. Illustrated booklet available separately at 1/6. Attractive metal cover, now available, with built-in carrying handle **19/6.**
STUPENDOUS HALF-PRICE OFFER!! DECCA SINGLE SPEED RECORD PLAYING DECKS 28A. Easily converted to either Standard or L.P. Price with one crystal cartridge of either type **£4/19/6;** or with both cartridges, **£5/19/6.** Plus 5/- P. & P.
F.C.I. 10 WATT AMPLIFIERS. Measure 12in. × 6in. × 6in. Valve line up—6AM6, 6AM6, 6SN7, 6P4, 6P6a Push Pull. Separate Bass and Treble controls, multi-ratio output transformer for 3 ohm or 15 ohm speakers. Fully guaranteed!! **£10/15/-** plus 5/- P.P.
We also have in stock—Connoisseur 3-speed motors, pick-ups. Pick-ups and heads by Garrard, Decca, Collaro, Acos, Chancery, etc., etc., at current prices.
AMPLIFIER BARGAIN. "THE EMPRESS" Super quality push-pull 4 valve 4 watt amplifier. Ideal for record or radio tuner reproduction. Measures only 7½in. × 7½in. × 9½in. Valve line-up EL.84, EL.84, EF.41, ECC.83, for use with one or two 3-ohm speakers. Price **£7/7/-** plus 3/- P. & P.
PORTABLE CABINETS. Manufacturers' surplus. Well made brown rexine covered. Will take any standard single player with bottom clearance of 3in. Total size closed 16in. × 13½in. × 8½in., fitted with snap catches and carrying handle, **22/6** only, plus 2/6 P. and P.

CLYNE RADIO LTD.

18, Tottenham Court Road, London, W.1.

The Walk-around Shop

all these fine offers are on display at :

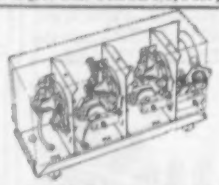
PROOPS BROS. LTD. 52, TOTTENHAM COURT ROAD, W.1

TEST SET 87

Made by famous instrument maker

Available complete including :—
POWER PACK. 200/250 v. 50 cycle Power Pack. Fully smoothed, 250 v. 50 mA., with 6.3 v. 4½ A., L.T.
R.F. OSCILLATOR. RL18 oscillator 150-300 Mc/s; easily altered to TV or FM Bands with the use of 4 inches of tinned copper wire.
MODULATOR AMPLIFIER. Two-valve Modulator/Amplifier for RL18.
PULSE AMPLIFIER. Six-valve Pulse Amplifier using VR65s.
TEST SET 87 can be easily altered to **TV PATTERN GENERATOR** or to **WIDE RANGE RC AUDIO OSCILLATOR** as fully described in M. G. Scroggie's articles in "*Wireless World*" issues dated August and September 1949.
Circuit diagrams available at 2/6 each.
TEST SET 87 is housed in a robust steel cabinet 23in. × 8½in. × 10in. high, copper plated and stove enamelled; fitted with chrome handles.
An exceptionally fine bargain.
PRICE, Complete with 10 valves (5Z4G, RL18 and 8 VR65s) **£5:0:0** *Carriage 10/-.*

WIND FINDING ATTACHMENT for Air Speed Indicator. Comprising two small counters. Two Desyn type follower motors. (Ideal for an antenna direction indicator. Size of motors 1½in. long, 1in. diam., 6-way terminal block. Toggle switch. Housed in metal outer case, fitted with plastic 360 degree dial. **PRICE 8/6,** Post paid.



R.F. UNIT (Ex-BC800). 800.) Can be converted for use on 2 metres or 70 cm. Contains (3) 956 valves, etc. Brand new in tropical packed cartons.

PRICE 17/6

Post Paid

RECEIVER UNIT Ex-TR1143A. Suitable for conversion to 2 metres and F.M. Wrotham. Circuit diagram free. Price, less valves, 9/-, post paid.
TRANSMITTER UNIT Ex-TR1143A. Suitable for conversion to 2 metres. Circuit diagram and coil conversion details supplied free. Price, less valves, 5/-, post paid.
AMPLIFIER UNIT Ex-TR1143A. A 3-stage transformer coupled amplifier. Push-pull VT52's output to modulate push-pull VT501's. Circuit diagram free, 4/6, post paid.
INSPECTION LAMP. 2 pole S.B.C. Holder with 6ft. spring loaded lead in case 3in. × 3in. × 4in. with on-off switch on front panel. Price 6/-, post paid.
TOGGLE SWITCHES. 5 amp. 1-way recessed panel type, 1/-, post paid.
SLOW MOTION DRIVE. Reduction 40-1. Excellent for S.W. operation. Price 3/6, post paid.
INDICATORS. Aircraft undercarriage type with 4 miniature E.S. holders in bakelite case. Price 1/6, post paid.
CRYSTALS by R.C.A. 100 kc/s. 3-pin mounting. Price 12/6, post paid.
POINTER KNOBS. 1in. radius, fitting ¼in. spindle. Black bakelite; 3 for 2/6, post paid.
BLOCK CONDENSERS. 8 mfd. 600 v. W. tropical. 750 v. w., normal. Price 5/-, post 1/-.
23-WAY SWITCH. Make before break. Incorporating a single pole 3-way Yaxley type switch. Price 3/6, post paid.
HEATER TRANSFORMERS. 6.3 v., 1.5 A. output, 230 v. input. Price 7/-, post paid.
TANNOY P.A. SPEAKERS. 8 watt, 6in. diam. P.M. with re-entrant baffle mounted in wooden cabinet with line OP trans. Military surplus Cat. No. ZB11565. Price 20/-, post paid. Enquiries invited for quantities.
HEADBAND TORCHES. (Leave both hands free for awkward jobs). M.E.S. holder, bulb and reflector, headband with rubber pad, battery box with 4ft. cable; all wired ready for use. **PRICE 4/-,** post 1/-. Needs 4½ v. battery Vidor VOO17 or similar standard battery.
VALVES. 6SN7gt 6/9. (Ex-new surplus units) 807 (American) 8/6. Disc-Sealed Triode (Lighthouse tube GL446A (19E4) Boxed, New, 25/-. All post paid.
ALL RADIO MINDED AMATEURS should send for full details of the "Medresco" Deaf-Aids which can be converted into many interesting devices including: 1. A Crystal Receiver incorporating a Germanium Diode. Circuit requires no alteration to present wiring. 2. An O-V-2 (detector with two stages of amplification) receiver. (*Circuits for these two supplied free.*) "**Medresco**" Units, all in perfect working order (checked by experts), complete with Crystal Microphone and incorporating three miniature valves, are **a wonderful bargain** at only 27/6 each. Postage 1/-. See our full-page advertisement in "*Wireless World*," January issue (Page 126).

We have a well organised Post Order Dept. giving prompt service.
NOTE:—*Orders and Enquiries to* Dept. 'W.'
PROOPS BROS. LTD., 52, Tottenham Court Road, W.1.
Shop hours : 9 a.m. to 6 p.m. Thursday : 9 a.m. to 1 p.m.
OPEN ALL DAY SATURDAY. **LANgham 0141.**

D. COHEN

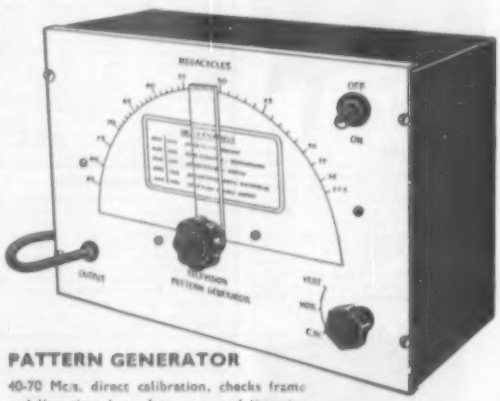
RADIO AND TELEVISION COMPONENTS

23, HIGH STREET, ACTON, W.3

(Opposite Granada Cinema)

COMPLETELY BUILT SIGNAL GENERATOR

Coverage 120 Kc/s-320 Kc/s., 300 Kc/s-900 Kc/s., 900 Kc/s.-2.75 Mc/s., 2.75 Mc/s.-8.5 Mc/s., 8.5 Mc/s.-25 Mc/s., 17 Mc/s.-50 Mc/s., 25.5 Mc/s.-75 Mc/s. Metal case 10 × 6½ × 4½in. Size of scale 6½ × 3½in., 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent., modulated or unmodulated, R.F. output continuously variable 100 milli volts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Black crackle finished case and white panel. Accuracy plus or minus 2%. **£4/19/6**, or 34/- deposit and 3 monthly payments **25/-**. P. & P. 4/- extra.



PATTERN GENERATOR

40-70 Mc/s. direct calibration, checks frame and line time base, frequency and linearity, vision channel alignment, sound channel and sound rejection circuits and vision channel band width. Silver plated coils, black crackle finished case 10 × 6½ × 4½in. and white front panel. A.C. mains 200/250 volts. This instrument will align any T.V. receiver, accuracy plus or minus 1%. Cash price **£3/19/6** or 29/- deposit and 3 monthly payments of **£1**. P. & P. 4/- extra.

EXPORT & TRADE ENQUIRIES INVITED

(N.B. Post and packing charges stated apply to British Isles only.)

★ **Both generators guaranteed for 12 months** ★

MAINS TRANSFORMERS

Primary, 200-250 v. P. & P. 2/-.
200-0-200, 100 mA., 6 v. 3 amp., 5 v. 2 amp., **22/6.**

Drop thro' 250-0-250 v. 70 mA., 6 v. 2.5 amp., 5 v. 2 amp., **14/6.**

Drop thro' 250-0-250 v. 80 mA., 6 v. 3 amp., 5 v. 2 amp., **14/6.**

250-0-250, drop through, 80 mA., 6 v. 3 amp., 5 v. 2 amp., **14/6.**

250-0-250 80 mA., 6 v. 4 amp., **14/-.**

Drop thro' 270-0-270, 80 mA., 6 v. 3 amp., 4 v. 1.5 amp., **13/6.**

Drop thro' 270-0-270 60 mA., 6 v. 3 amp., **11/6.**

350 v. 350 mA., 6.3 v. 4 a., twice 2 v. 2 a. **19/6.**

Auto-trans. Input 200/250, H.T. 500 v. 250 mA., 6 v. 4 a., twice, 2 v. 2 a., **19/6.**

250-0-250, 60 mA., 6.3 v. 1.5 a. 0-5-6.3 v. 1.5 a., **10/6.**

Auto Trans. Input 200/250. H.T. 350 v. 350 mA. Separate L.T. 6.3 v. 7 a., 6.3 v. 1½ amp., 5 v. 3 amp., **25/-.** P. & P. 3/-.

Heater Transformer. Pri. 230/250 v. 6 v. 1½ amp., **6/-;** 2 v. 2½ amp., **5/-.**

Pri. 200/250. Secondary 9 v. 3.5 amp., 6.3 v. 3 amp., **12/6.**

Pri 200 v. Sec. 500-0-500 and 500-0-500 250 mA. both windings. 4 v. 3 amp. 4 v. 3 amp., **39/6.** P. & P. 5/-.

Mains Transformer, fully impregnated, input 210, 220, 230 and 240. Sec. 600-0-600, 275 mA., and 250 v. at 80 mA., complete with separate heater transformer. Input 210, 220, 230, 240. Sec. 6.3 v. 2 amp. three times, 0, 4, 6.3 v. at 3 amp. and 5 v. 3 amp., **45/-.** P. & P. 5/-.

Mains Transformer, fully impregnated. Input 210, 220, 230, 240. Sec. 350-0-350 100 mA., with separate heater transformer. Pri. 210, 220, 230, 240. Sec. 6.3 v. 2 amp., 6.3 v. 2 amp., 4 v. 6 amp., and 5 v. 2 amp., **30/-.** P. & P. 5/-.

MAINS TRANSFORMERS, chassis mounting, feet and voltage panel. Primaries 200/250.

350-0-350 75 mA. 6.3 v. 3 a. tap 4 v. 6.3 v. 1 a., **13/6.**

500-0-500 125 mA. 4 v. C.T. 4 a., 4 v. C.T. 4 a., 4 v. C.T. 2.5 a., **27/6.**

500-0-500 250 mA. 4 v. C.T. 5 a. 4 v. C.T. 5 a. 4 v. C.T. 6 a., **39/6.**

9in. T.V. Cabinet, front in contrasting walnut veneers, size 16½in. long, 11¼in. high, by 12½in. wide. Complete with two pieces expanded aluminium in gold, 12 × 9in. and 5in. speaker baffle and chassis, **20/-,** post paid.

6½in. M.E. Speaker, 1,000 ohm field, **15/-.**

R. & A. T.V. energised 6½in. speaker with O.P. trans., field coil 175 ohms **9/6.** P. & P. 2/6.

R. & A. 6½in. M.E. speaker with O.P. trans. field 440 ohms **10/6.** P. & P. 2/6.

Volume Controls. Long spindle less switch, 50K, 500K, 1 meg., **2/6** each. P. & P. 3d. each.

Volume Controls. Long spindle and switch, ¼, ½, 1 and 2 meg., **4/-** each; 10K and 50K, **3/6** each. 1 and 1 meg., long spindle double pole switch, miniature, **5/-.** P. & P. 3d. each.

Trimmers, 5-40 pf., **5d.** 10-110, 10-250, 10-450 pf., **10d.**

Twin-Gang .0005 Tuning Condenser, 5/-. With trimmers, **7/6.**

Twin Gang .0005, with feet, size 3½ × 3 × 1¼in., **6/6.**

3-gang .0005, with feet, size 4½ × 3 × 1¼in., **7/6.**

T.V Coils, moulded former, iron-cored wound for re-winding purposes only. All-can 1¼ × 1¼in., **1/-** each, 2 iron-core All-can 2¼ × 1in., **1/6** each.

Used Metal Rectifier 250 v. 150 mA. **6/6.**

Metal Rectifier 230 v. 45 mA., **6/-.**

Metal Rectifier EM3, 125 v., 100 mA. **3/6.**

Mains Droppers, 0.3 amp., 460 ohms, tapped 280 and 410, **1/6;** 0.3 amp., 717 ohms, tapped at 100 ohms vitreous, **1/6;** 0.3 amps. 920 ohms, tapped 700 and 825, **2/6;** 0.3 amp., 1,000 ohms vitreous, tapped, **2/6;** vitreous, 0.3 amp., 700 tapped 600, 640, 600, **3/6.** P. & P. on each 3d.

T.V. Width Controls, 3/6.

D. COHEN

RADIO AND TELEVISION COMPONENTS

Terms of Business: Cash with order. Despatch of goods within 3 days from receipt of order. Where post and packing charge is not stated please add 1/6 up to 10/-, 2/- up to £1, and 2/6 up to £2. All enquiries, S.A.E., lists 5d. each.

SPECIAL NOTE: NO GOODS SENT WHERE CUSTOMS DECLARATION IS APPLICABLE

23 HIGH STREET (Uxbridge Road)
ACTON, W.3. Telephone: ACOrn 5901.

Hours of Business:
Saturday 9—5 p.m. Wednesday 9—1 p.m. Other days 9—4.30 p.m.

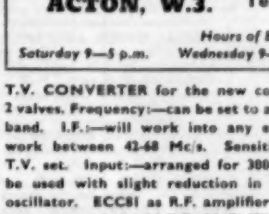
T.V. CONVERTER for the new commercial stations complete with 2 valves. Frequency:—can be set to any channel within the 186-196 Mc/s. band. I.F.:—will work into any existing T.V. receiver designed to work between 42-68 Mc/s. Sensitivity:—10 Mu/v with any normal T.V. set. Input:—arranged for 300 ohm feeder. 80 ohm feeder can be used with slight reduction in R.F. gain. Circuit EF80 as local oscillator. ECC81 as R.F. amplifier and mixer. The gain of the first stage, grounded grid R.F. AMPLIFIER 10 db. Required power supply of 200 v. D.C. at 25 mA. 6.3 v. A.C. at 0.6 amp. Input filter ensuring complete freedom from unwanted signals. 2 simple adjustments only. £2/10/-. P. & P. 2/6.

USED 12in. TUBE, aluminised, heater cathode-short, 12KV max. 2 v. heater complete with line and E.H.T. transformer 9 KV with ferrocart core, line and width control, EV51 rec. winding frame O.P. scan coils and 12in. perspex escutcheon. **£6/17/6.** P. & P. 7/6.
As above but with 12in. non-aluminised tube 8KV max. **£5/17/6.** P. & P. 7/6.

GENERAL PURPOSE 5-IN-1 MAINS TRANSFORMER. Input 200/250. Sec. 350 v. 350 mA., 6.3 v. 4 amp. twice, 2 v. 2 amp. 500 v., 350 mA., 6.3 v. 4 amp. twice, 2 v. 2 amp. Auto-transformer, 110/250 v., 250 watt. **19/6.** P. & P. 3/6.

HIGH-IMPEDANCE PLASTIC RECORDING TAPE, by famous manufacturer. 600ft. on aluminium spool, **9/-.** 1,200ft. on aluminium spool, **17/6,** post paid.

PLASTIC CABINET, as illustrated, 11½ × 6¾ × 8¼in., in Walnut, Cream and Green, also in polished Walnut complete with T.R.F. chassis, 2 waveband scale, station names, new wave-band, back-plate, drum, pointer, spring, drive spindle, 2 knobs and back. **22/6.** P. & P. 3/6.



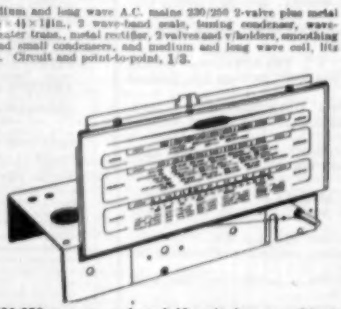
AS ABOVE, with superhet chassis, **25/6.** P. & P. 3/6.
Useful metal rectifier, 230 v. 50 mA., **3/6.**
Ganged with trimmers, **6/6;** M. & L. T.R.F. coils, **5/-;** 3 obsolete ex-Govt. valves 3 v/h and circuit, **4/6;** heater trans., **6/-;** volume control with switch, **3/6;** wave-change switch, **2/-;** 99 × 37 mfd., **4/-;** bias condenser, **1/-;** resistor kit, **2/-;** condenser kit, **4/-;**

Cyldon 5 channel T.V. Tuner, uses EF80 and 12AT7 less valves, **12/6,** post paid.
Radiogram Chassis, 5 valve A.C./D.C. 3 wave-band superhet 195-555 v., 19-49, 200-550 and 1,000-2,000 metres, I.F. 470 Kc. size of chassis 13 × 6½ × 3½in., size of scale 7½ × 3½in. valve line-up 16C1, 10F9, 10LD11, U404 and 10P14. Twin mains filter input, 3 dial lights and 8in. P.M., **£6/17/6.** P. & P. 5/-.

CR100 Coil packs in first-class condition less oscillator section, complete with 4-gang tuning condenser. 19/6. P. & P. 3/6.
CR100 465 Kc. I.F.s, types 3, 4 and 5 and F.B.O., new condition, 7/6 each.
465 Kc. Xtal for CR100, 12/6.
4-gang tuning condenser for CR100, 9/6.

CONSTRUCTOR'S PARCEL, medium and long wave A.C. mains 230/250 2-valve plus metal rectifier, comprising chassis 10½ × 4½ × 1¼in., 2 wave-band scale, tuning condenser, wave-change switch, volume control, heater trans., metal rectifier, 2 valves and v/holders, smoothing and bias condensers, resistors and small condensers, and medium and long wave coil, 1½z wound, **22/6.** P. & P. 2/6 extra. Circuit and point-to-point, 1/3.

CONSTRUCTOR'S PARCEL comprising chassis 12½ × 8 × 2¼in., cad. plated, 16 gauge, v/h., I.F. and trans. cut-outs, back-plate, 2 supporting brackets, 3 wave-band scale, new wavelength stations names, size of scale 11½ × 4¼in., drive sp., drum, 2 pulleys, pointer, 2 bulb holders, 5 pax. I.O. v/h., 4 knobs and pair of 465 I.F.s, twin gang, 16 × 16 mfd. 350 wkg., mains trans. 250-0-250 60 mA., 6.3 v., 2 amp., 5 v. 2 amp. and 6½in. M.E. speaker with O.P. trans. **39/6.** P. & P. 3/6.



Battery charger, input 230/250 v. output 6 and 12 volt 1 amp. Black crackle finished case size 10 x 6 x 4in. Incorporating metal rectifier, mains on-off switch, and output switch. 21/-. P. & P. 3/-.

OUTPUT TRANSFORMERS. Standard type 5,000 ohms imp., **4/9;** 42-1 with extra feed-back windings, **4/3.** Miniature 42-1, **3/3.** Multi-ratio 2,500, 7,000 and 14,000. **5/6.** 10-watt push-pull 6V6 matching, **7/-.** 90-1 3 ohm speech coil, **6/6.**

PUSH-BACK CONNECTING WIRE. Doz. yds., **1/6.** Post paid.

STANDARD WAVE-CHANGE SWITCHES 4-pole 3-way, **1/9;** 5-pole 2-way, **1/9;** 5-pole 3-way **1/9;** 9-pole 2-way, **2/6;** Miniature type, long spindle 3-pole 4-way, 4-pole 2-way and 4-pole 3-way, **2/6** each. 2- pole 11-way twin wafer **5/-;** 1-pole 12-way single wafer **5/-.** P. & P. 3d.

POTATO AND VEGETABLE PEELER

By famous manufacturer. To suit models A200 and A700. Capacity 4½lb., complete with water pump. All aluminium construction, white stove-enamelled finish. Originally intended for adaptation on an electric food-mixer, can be easily converted for hand operation. 39/6. P. & P. 3/-.

PERSONAL SHOPPERS ONLY. 9in. Enlarger. **17/6;** 13in., **27/6.**

Germanium Crystal Diode, 1/6, post paid.

Used 9in. Tube, with ion burn, **17/6,** post paid.

Line O.P. Transformer in aluminium can mounted in rubber, **12/6.**

Crystal Set, medium and long wave, in plastic cabinet, **16/-.**

Headphones, per pair **8/-.**

Speaker Matching Unit on aluminium chassis, 3-15 ohms reversible, **12/6.**

Line and E.H.T. Transformer, 14 Kv., using ferrocart core, complete with line and width control, and corona shields U37 rectifier winding, **35/-.**

Line and E.H.T. Transformer, 9 Kv. using ferrocart core, complete with built-in line and width control. Mounted on small all-chassis. Overall size 4½ × 1¾in. EV51 rec. winding, **27/6.**

Scan Coils, low line low impedance frame, complete with frame transformer, to match above, **27/6.** P. & P. 2/-.

Line and E.H.T. Transformer, 9 Kv., ferrocart core, EV51 heater winding, complete with scan coils and frame output transformer, and line and width control, **£2/5/-.** P. & P. 3/-.

As above, but complete with line and frame blocking transformers, 5 Henry 250 mA. choke, 100 mfd. and 150 mfd., 350 wkg. 200 mA. A.C. ripple. **£3/19/6.** P. & P. 3/-.

Valve Holders, moulded octal Mazda and ioctal, **7d.** each. Paxolin, octal Mazda and ioctal, **4d.** each. Moulded B7G, B8A and B9A, **7d.** each. B7G moulded and B9A with screening can **1/6** each.

32 mfd., 350 wkg.	3/-
16 × 24, 350 wkg.	4/-
4 mfd., 200 wkg.	1/3
40 mfd., 400 wkg.	4/6
16 × 8 mfd., 500 wkg.	4/6
16 × 16 mfd., 500 wkg.	5/9
16 × 16 mfd., 450 wkg.	5/9
32 × 32 mfd., 350 wkg.	4/-
32 × 32 mfd., 350 wkg., and 25 mfd., 25 wkg.	6/6
25 mfd., 25 wkg.	1/6
250 mfd., 12 v. wkg.	1/-
16 mfd., 500 wkg., wire ends	1/3
8 mfd., 500 v. wkg., wire ends	1/6
8 mfd., 350 v. wkg., tag ends	1/6
50 mfd., 25 v. wkg., wire ends	1/9
100 mfd., 350 wkg.	4/-
100 mfd., 400 v. wkg., 200 mA. A.C. ripple	3/11
150 mfd., 350 v. wkg., 200 mA. A.C. ripple	4/6
100 + 200 mfd., 350 wkg.	4/6
16 + 16 mfd., 350 wkg.	3/3
50 mfd., 150 wkg.	1/3
65 mfd., 220 wkg.	1/6
8 mfd., 150 wkg.	1/3
60 + 100 mfd., 300 wkg.	4/6
50 mfd., 12 wkg.	1/6
32 + 32 mfd. min. 275 wkg.	4/-
50 mfd., 50 wkg.	1/9

Miniature wire ends moulded, 100 pf., 500 pf., and .001, each... **7d.**

T.V. Filter in lightly tinted Perspex size 13½ × 11 × 3/16in. **4/6.**

Combined 12in. mask and escutcheon in lightly tinted Perspex. New aspect, edged in brown. Fits on front of cabinet, **12/6.** As above for 15in. tube, **17/6.**

Frame Oscillator Blocking Trans. 4/6.

Line Osc. Blocking Trans. 4/6.

Tube Mounting Bracket, size 9½ × 4½in. 12in. tube clamps, **2/-.**

CHOKES:
2-20 Hen. 150 mA., **15/-.** P. & P. 3/-.
6 Hen., 275 mA., **15/-.** P. & P. 3/-.
100 Hen., 40 mA., **15/-.** P. & P. 3/-.
2 henry 150 mA., **3/6;** 200 mA. 10 henry **10/6.** 5 henry 250 mA. 60 ohms., **8/6.**

P.M. Focus Unit for any 9 or 12in. tube except Mazda 12in., with Vernier adjustment, **15/-.**

P.M. Focus Unit for Mazda, 12in., with Vernier adjustment **17/6.**

Wide Angle P.M. Focus Units, Vernier adj. state tube, **25/-.**

Energised Focus Coil, low resistance mounting bracket. **17/6.**

Ion Traps for Mullard or English Electric tubes, **5/-,** post paid.
Standard 465 Kc. iron-cored **I.F.s,** 4 × 1½ × 1½in., per pr., **7/6.** Wavin standard iron-cored, 465 Kc. **I.F.s** 3½ × 1½ × 1½in., per pr., **9/6.**

Iron-Cored 465 Kc. Whistle Filter, **2/6.**

465 KC. MIDGET I.F.s. Q 120 size 1½in. long, 1in. wide, 1in. deep by very famous manufacturer. Pre-aligned adjustable iron-dust cores, per pair **12/6.**

GEE-RADIO

ELENIUM METAL RECTIFIERS (S.T.C. TYPE). Built to specification from milliamps to amps., H/W., F/B., or three-phase. All work fully guaranteed. Very good delivery. Your enquiries invited for large or small quantities.

RECTIFIERS, PENCIL TYPES, S.T.C. K/3 SERIES. 1 milliamp for H.T. and E.H.T. APPLICATION, EX-STOCK.

Volts	Type	Price	Volts	Type	Price	Volts	Type	Price
248	K3/10	3/10	1000	K3/40	7/6	2550	K3/100	14/8
375	K3/15	4/5	1140	K3/45	8/2	3080	K3/120	16/8
500	K3/20	5/1	1260	K3/50	8/8	3600	K3/140	19/3
655	K3/25	5/8	1500	K3/60	9/8	4100	K3/160	21/6
755	K3/30	6/-	1780	K3/70	11/-	4660	K3/180	24/3
885	K3/35	6/10	2030	K3/80	12/4	5150	K3/200	26/-

RECTIFIERS FOR L.T. APPLICATION—F/B. S.T.C. TYPE: 12 v. D.C. at 1 amp., 6/6; 12 v. D.C. at 2 amp., 10/6, p.p. 9d. 12 v. D.C. at 3 amp., 15/-, p.p. 1/-; 21 v. D.C. at 4 amp., 17/6, p.p. 1/3; 12v. D.C. at 6 amp., 25/-, p.p. 2/-; 12 v. D.C. at 10 amp., 40/-, p.p. 2/6; 24 v. D.C. at 1 amp., 12/6; 24 v. D.C. at 2 amp., 21/-, p.p. 1/-; 24 v. D.C. at 4 amp., 30/-, p.p. 2/-; 24 v. D.C. at 6 amp., 35/-, p.p. 2/6.

VALVE TESTER, TYPE 4. 200/230 v. A.C. input. Ex-Govt., in good condition, with descriptive book containing circuit diagram of instrument and how to test valves from 1.4 v. to 40 v. With valve-holders for Brit., 4, 5, 7 pin and Octal, U.S., 5 and 7 pin, 1/Octal, side contact, large Brit., 4 and 9 pin. Acorn and diode. Housed in substantial wooden case. Price £7/19/6, carriage 10/- extra.

WESTON ALL-PURPOSE A.C./D.C. TEST METER, MODEL E.665. 1,000 ohms per volt. New and unused, complete with leads and batteries. £8 each only, p.p. 3/6.

WESTON BATTERY OSCILLATOR, MODEL E.692. TYPE 2. Also new and unused. Coverage 100 kc/s-26 Mc/s. Audio output approx., 400 c/s. Available at the ridiculously low price of only £5/19/6, p.p. 4/6. (Oscillator complete with instruction booklet.)

TELEPHONE L/SPEAKER No. 2 (By Vitavox). This is H/Duty 6in. P.M. 15 ohm S/C. with 600 ohm built-in Link Transformer, housed in strong wooden case. £1/8/-, carriage 5/-.

VITAVOX PRESSURE UNITS. Heavy duty, P.M. 20 watts. Brand new. £4/9/6, carriage 5/-.

TRUVOX 12in. 3 OHMS P.M. SPEAKERS. Brand new and boxed, 39/6, post paid.

ROTARY CONVERTERS. 12 v. D.C. input 230 v. A.C. output, at 100 watts. Brand new. £4/17/6. Ditto, 24 v., same price, carriage 7/6.

AN/APA-1 CATHODE RAY INDICATOR AMPLIFIER UNIT. Complete, comprising OF. 3BP1 C.R.T., 7-6SN7GT, 1-6H6, 1-6G6, 1-2X2, 1-6X5, valves. Bargain value, £4/19/6, plus 10/- carriage.

TUNING UNITS (EX-U.S.A.). Types available, T.U.6B., T.U.9B. T.U.26B. Good condition, soiled cases, 19/6 each, p.p. 3/-.

AC/DC SUPPLY UNIT. (S.T.C. SELENIUM RECTIFIER). Complete with Mains isolation transformer, fixed and housed in strong metal cabinet. 250 v. A.C. to 200-220 v. D.C. @ 3-4 amps. Ready to use for £6/10/- only, carriage 10/-.

CAR RADIO TRANSFORMERS. 12 v. ex-Philco, 300 v. H.T. at 90 mA. Brand new and unused. Only 12/6, p.p. 2/-. 12 v. Oak Vibrators, 4-pin U.X. base, new and unused, 7/6 each., p.p. 9d.

TRANSFORMERS PUSH-PULL OUTPUT (BY PARMEKO) 25 watts for 6L6 valves. To match, 3, 8 and 15 ohms. New and unused. 29/6, p.p. 2/6.

R.1155 COMMUNICATION RECEIVERS. Individually tested and despatched in good working order. Cases slightly soiled. £8/19/6, carriage 10/-.

RECEIVER TYPE 109 in good condition. Freq. range 15-68 metres continuous, designed to operate on 6 v. battery. Limited quantity only £4/7/6, plus 10/- carriage.

N.C. 38 WALKIE-TALKIE TRANS-RECEIVER, in good condition (less external accessories), 35/-, p.p. 2/6.

HALF MILE OF TWIN DON "8" TELEPHONE WIRE. Brand new, on wooden drums, £2/12/6 per drum, carriage 10/-, England only.

HIGH-VOLTAGE TRANSMITTING CONDENSERS. Hank Pot Type (25 pf. 8 kV.) (40 pf. 9.6 kV.) (500 pf. 15 kV.) (600 pf. 9.6 kV.) (750 pf. 15 kV.). Any type, 3/6 each, p.p. 1/-.

TELESCOPIC AERIALS. Min. length 12in. Max. length 48in. Suitable for car radio aerials. 8/6 each, p.p. 9d.

CATHODE RAY TUBES.

Type 3BP1, 3in., new and unused, with base and screen, 42/6, p.p. 2/-.
Type VCR 138 (ECR35). 3½in. With screen and base, in new and unused condition, 42/6, p.p. 2/-.
Type VCR97, 6in., ex-equip. in good order, 30/-, p.p. 3/6.
VCR131, 1in. C.R.T., new and in perfect condition. Miniscope replacement tube, etc., 35/-, p.p. 1/-.
Type CV 1526, 2½in., 4 v. filament, 3,000 v. anode, complete with base and mu-metal screen, 30/-, p.p. 2/6.

PHOTO ELECTRIC MULTIPLIER CELLS. TYPE 931A. £2/10/-, p.p. 1/-. Also 931A complete on chassis with multiplier network and two 832 valve-holders, etc., £3/10/-, p.p. 2/-.

4 CORE 3/036 "METAFLEX." V.I.R. in flexible tubing, 1⅛th dia. overall, 2/6 per yard., p.p. 2/6.

SIEMENS HIGH SPEED RELAYS. Twin 1,000 ohm coils, perfect condition, 15/-, p.p. 6d.

2,000 OHMS H/R. EAR PIECES, 3/6 each, p.p. 9d.

BATTERIES H.T./L.T. Heavy duty layer type. 150 v. tapped at 87 v. H.T. L.T. 4½ v. Perfect condition. Size 9½in. x 4½in. x 4½in., 4/6, p.p. 2/6.

15 LITTLE NEWPORT ST., LONDON, W.C.2.

GERrard 6794/1453

G2AK *This Month's Bargains* G2AK

T.V. POWER TRANS. By Parmeko. Pri. 200/250 v. EHT 6 kV. (RMS) 350/350 v. 250 mA., 6.3 v. 6 a., 4 v. 3 a., 4 v. for EHT Rec. Wired to Holder. Beautiful job. £4/10/-, carr. paid. FEW ONLY.

METERS. 2½in. Flush mounting M.C. 100 mA., 0-10 mA., 0-30 mA., 12/6 ea.; 0-15 A., proj. thermo. 2½in., 7/6; 0-9 A. hot-wire, 5/-.

TEST METER. 7 ranges as follows: 1.5 v., 3 v., 150 v. 6 mA., 60 mA., 5,000 ohms, 25,000 ohms 2½in. dia. scale M.C. meter. Rotary selector switch. Black bakelite case, 6 x 4½ x 4½ fitted with removable lid, also provision for internal batts., ranges can be easily extended. Bargain price 30/-, plus 1/6 post.

SPECIAL OFFER, ARM SPARES. Cabinets, complete with base, feet and side strips, £4/15/- each. Pkg. and Carr. 5/-. Set of 14 valves for "D" or "LF" model receivers, £5/10/-. Panel escutcheons, 22/6 each. "D" type I.F.S., 12/6 each. Good selection of Spare Coils available for "D" Model, 7/6 each. Output Transformers for "D" or "LF," 37/6 each.

CRYSTAL HAND MICROPHONES. Complete with lead and plug. High quality, very sensitive, chrome finish. List price 2 gns. Our price 24/-. Few only.

COPPER WIRE. 14G H.D. 140ft. 15/-, 70ft. 7/6, postage and packing, 2/-. Other lengths pro rata.

SPECIAL VALVE OFFER. 866A, 17/6 each, or 30/- pair. 807's, 10/- each or 17/6 pr. 931 A, 45/-, 829B, 60/-. TZ40 35/-, 813's 80/-.

STREAMLINED BUG KEYS. By famous manufacturer. List over £4. Our price 45/-. **AIR SPACED COAXIAL CABLE,** 150 ohm (normal price 3/11 per ft.), 20 yd. coils only. £1 per coil, post free.

NEW MULLARD QUALITY AMPLIFIER chassis, and all specified parts available from stock.

Carriage paid on all orders over £1 except where stated. Please include small amount for orders under £1.

Please print your name and address. *All Mail Orders to:—*

CHAS. H. YOUNG, G2AK

Dept 'W' *102 HOLLOWAY HEAD, BIRMINGHAM 1*
'Phone: MIDLAND 3254

All callers to ***110 DALE END, BIRMINGHAM 4***
'Phone: CENTRAL 1635

SAMSON'S SURPLUS STORES

SPECIAL OFFER A.M. H.T. TRANSFORMERS. Pri. 200-240 v. Sec. 525-0-525 v. 150 mA., 5 v., 3 a., 6.3 v. 1.5 a., 55 v. 50 mA., 39/6, P.P. 2/6.
BRAND NEW METERS BY FAMOUS MAKERS. 4in. Round flush M1 Ammeters, 0-40 amps. 500 c/s., 37/6, P.P. 2/-. 3½in. round flush MC 0-400 mA., 30/-, P.P. 2/-. 2½in. round flush MC 0-500 mA., 15/-, P.P. 1/6.
LIGHTWEIGHT UNSPILLABLE P. & G. 2-VOLT 7 AH. AT 10 HR. RATE ACCUMULATORS. Size 4½in. x 3¼in. x 11in., 15/-, P.P. 1/-.
EXIDE 10 volt 3 Ah. Glass with cadmium, size 7in. x 2¾in. x 5in. suitable for H.T. unit construction and models, etc., 17/6, P.P. 1/6. **MINIATURE ACCUMULATORS** made by Willard Co. 20 volt 0.2 Ah. Note size and weight. 3¼in. x 1¼in. x 1in., weight 5½ oz., 5/-, P.P. 6d., or set of three 36 v. and one 6 v. same size but weight 4½ oz. in sealed metal container, 21, P.P. 1/3. Easily filled with hypodermic syringe.
EX-ARMY MEDICAL HYPODERMIC SYRINGE. Brand new. 1 c.c. with needle, 4/9, P.P. 6d. 10 c.c., with needle, 7/6, P.P. 6d. Extra needles, tin of 5, 2/-, P.P. 6d.
AMERICAN 6 VOLT 90 AH. 13 PLATE CAR BATTERIES. Size 9in. x 9in. x 7in. Brand new in maker's cases, £2/19/6, carr. 7/6.
PRICHETT AND GOLD STORAGE BATTERIES. 12 volt 75 Ah. Built in teak cases. Brand new, £4/15/-, carr. 7/6.
AMERICAN AIRCRAFT BATTERIES. 24 volt 11 Ah., by Willard. Size 8in. x 7¼in. x 7¼in., 50/-, carr. 7/6.
AMERICAN C.R. TUBES. 5 CP1. Brand new, 22/6, carr. 2/6. CRT Type NC13 [illegible] 35/-, carr. 4/-. **S.P. UNITS,** Type 24, 20-30 Mc/s., complete with valves, brand new, 15/-, P.P. 2/-.
INSTRUMENTS, ADMIRALTY INTEGRATORS, TYPE A 281. Incorporating very fine Galvo movement, coil 40 ohms. Centre zero to F.S.D. 1 microamp. Small mirror one meter radius. A very useful laboratory instrument, 69/-, carr. 2/6.
METRO-VICKERS MASTER VOLTMETERS, 0-20 volts A.C. 50 cy. M.I 6in. mirrored scale, 25/-, P.P. 1/6. A.M. 9in. panel mounting 500-0-500 microammeters, blank scale, brand new, 25/-, P.P. 1/-.
Howard Butler 0-150 volts D.C. M.C. built in 6in. square Bakelite case, 20/6, P.P. 1/6.
HEAVY DUTY A.M. L.T. TRANSFORMERS. Pri. 440 v. Sec. 220 v., in steps of 20 v. conservatively rated at 2.2 kW., weight approx. 90 lb. Half the above secondary can be obtained from 220 v. input, £9/10/-, plus carr. Pri. 230 v. Sec. 50 v. 30 amps., completely enclosed, £6/10/-, plus carr. Pri. 230 v. Sec. 12, 12.5, 14, 15 v., very conservatively rated at 60 amps., £6/5/-, plus carr. Pri. 115 v. Sec. 17 v. 15 amps. and 2.2. v. 15 amps., 35/-, carr. 4/-. Pri. 230 v. Sec. 8.2 C.T., very conservatively rated at 10 amps., 25/-, carr. 2/6. Pri. 200-250 v. Sec. 115 v. 8.7 amps., £5/15/-, carr. 5/-.
A.M. H.T. TRANSFORMERS. Pri. 230 v. Sec. 1,500 v. 1.6 kVA, 65/-, carr. 7/6. **1154 TX H.T. TRANSFORMERS.** Pri. 200-250 v. Sec. 1250-1500 v. 200 mA., 25/-, carr. 4/-.
ADMIRALTY SOUND POWERED HAND SETS, no batteries required, 17/6, P.P. 1/6.

167/171 Edgware Road,
London, W.2. Tel: PAD 7851
125 Tottenham Court Road, W.1.
Tel.: EUS 4982

All orders and enquiries to our Edgware Road branch, please. This is open all day Saturday.

G.W. SMITH & CO (RADIO) LIMITED

Phone GERRARD 8204/9155

3-34, LISLE ST., LONDON, W.C.2.

TRADE ENQUIRIES INVITED

FOR ALL RADIO BARGAINS

WE PURCHASE ALL TYPES OF RECEIVERS AND TEST GEAR

AMERICAN "WESTON" OSCILLATOR TYPE 776. 50 Kc/s-30 Mc/s. Modulated or unmodulated R.F. output. 400 cycle audio output. Max. output voltage 100 m/volts. 110 volt A.C. operation, £12/10/- each.

METERS. All brand new and boxed, 0-1 m/a., desk type, fitted with 2½in. scale. Res. 100 ohms, 25/-; 0-1 m/a., 2½in. round, F/M., M/coil, 22/6; 0-5 m/a., 2in. square, F/M., M/coil, 7/6; 0-10 m/a., 2½in. round, F/M., M/coil, 10/-; 0-100 m/a., 2½in. round F/M., M/coil, 9/6; 0-150 m/a., 2in. square, F/M., M/coil, 7/6; 0-200 m/a., 2in. square, F/M., M/coil, 7/6; 0-200 m/a., 2½in. round, F/M., M/coil, 10/-; 0-20 volts, 2in. square, F/M., M/coil, 7/6.

AMMETERS. 0-1 amp., 2½in., projecting, R.F., 7/6 each; 0-5 amp., 2½in. round F/M., R.F., 7/6; 20/20 amp., 2in. round F/M., 6/6; 0-30 amp., 2in. square, F/M., M/coil, 7/6.

A.C. VOLTMETERS 50 CYCLE. 0-15 volts, 2½in. round, F/M., M/I., 8/6; 0-20 volts, 2½in. round F/M., M/I., 10/-; 0-300 volts, 2½in. round, F/M., M/I., 25/-; 0-300 volts, 5in. projection, M/I., 50/-; 0-300 volts, 3½in. M/I., housed in wooden case complete with two test leads, 39/6 each.

MICROAMP METERS. 0/100 2½in. flush panel mounting, scaled 0-1,500 yards, first-grade instruments, brand new and boxed, 42/6; ditto, scaled 0/50 microamp., 62/6.

CERAMIC TRANSMITTER SWITCHES. Extra heavy-duty silver contacts, 3in. dia., 1 pole, 6 way, 3 bank, 9/6 each; 1 pole, 6 way, 2 bank, 6/6 each; 1 pole, 4 way, 1 bank, 5/6 each.

TYPE 4 WAVE METERS. Cavity tuned absorption wavemeter covering 200-220 megacycles, brand new and boxed, supplied with VU39, SP61, EA50 and CV51 magic eye tuner, 29/6 each.

MAINS TRANSFORMERS. All 230 volt 50 cycle input. 250 x 250 volt 150 m/a., 4 volt 3 amp., 9/6 each; 500 x 500 170 m/a., 4 volt C.T. 4 amp., 3,000 volt insulation, 22/6 each; 670 x 670 volt 200 m/a., 6.3 volts 4 amp., 5 volts 3 amp., 49/6 each; 1,500 volts 330 m/a., 52/6 each; 2,000 volt 5 m/a., 15/6 each; 4 volt 14 amp., 6.3 volt 1½ amp., 10/6 each.

METER RECTIFIERS. Full bridge 2 m/a., S.T.C., brand new, 5/6 each.

UNISELECTOR SWITCHES. 4 bank double wipers, 25 position, 32/6. Ditto 8 bank, 45/-.

METER SWITCHES. Standard Yaxley type, 8 bank, single pole, 9, 11 or 12 way, 7/6 each.

H.R.O. 6 VOLT VIBRATOR POWER SUPPLY UNITS. Output 165 volt 80 m/a., 6.3 volts 3 amp. 6 x 5 rectifier, choke and condenser smoothed, cabinet size 7in. x 7in. x 6in. Supplied with clips and leads, brand new, 29/6 each.

P.40 POWER PACKS. Input 200/250 volts A.C. Output 175 volts 60 m/a., 12 volts 2.5 amp. Fully smoothed, 5Z4 rectifier, 32/6 each.

BATTERY CHARGERS. 200/250 volts A.C. input, 24 volts 10 amps. output, perfect working condition, £12/10/- each.

TELEPHONE HANDSETS. Ex-American, standard P.O. type, 12/6 each.

AMERICAN POWER RHEOSTATS. 8 ohm, 3.3 amp., 8/6 each; 8 ohm, 2.5 amp., 7/6 each; 60 ohm, 1.3 amp., 7/6 each; 90 ohm, 0.74 amp., 7/6 each; 200 ohm, 0.3 amp., 5/6 each. Ideal for train, model or charging control.

R.1155 COMMUNICATION RECEIVERS Individually aerial tested

BRAND NEW in origina transit case £11/19/6 each
BRAND NEW but shop soiled £9/19/6 ea.
USED MODELS but in perfect working order £7/19/6 each
A combined power pack and audio output stage for A.C. mains, can be supplied with a receiver for an extra cost of 79/6 each.

CHROMIUM PLATED TELESCOPIC AERIALS. Min. length 12in. extends to 40in. Ideal for car radios, etc., 7/3 each.

SOUND POWERED MICROPHONES AND RECEIVERS. No batteries required. Just connect wires to speak or listen, 3/6 each.

HEADPHONES. Brand new, Canadian "Northern Electric," finest ever produced, 50 ohm coils, complete with P.I. Jack Plug, 10/6 pair.

RELAYS. Polarised, twin 600 ohm coils, 8/6 each. We stock all types of relays, 600 and 3,000 types, heavy and light contacts including platinum. Send us your enquiries, we are the cheapest in the trade.

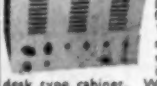
SIX FOOT P.O. RACKS. 19in. "U" Channel, 79/6 each.

PYE 45 MEG I.F. STRIPS. Complete television I.F. strip with 6 EF50 valves and 1 EA50 valve. Size 14in. x 3½in. x 3½in. Finest strip ever produced, 69/6 each complete. Brand new.

CHOKES. 20 henry 300 m/a., 13/6; 15 henry 275 m/a., 10/6; 20 henry 120/180 m/a., 10/6; 9 henry 100/150 m/a., 7/6.

TEST SETS TYPE 189. Brand new and boxed, fitted with 2in. 0-5 m/a., M/C., meter, also 0-40 volt 2in. M/C., meter, with mains plugs and leads and many other useful parts, 12/6 each.

FREQUENCY SCRAMBLERS. Type No. 6AC, YBO2700. For secret telephone transmissions, complete with all valves, £5 each.
P.O. KEY SWITCHES. Double pole changeover. Complete with knob, brand new, 2/9.



RECORD AMPLIFIERS. A quality push-pull 6V6 amplifier, 8 watts output. Will match any type speaker, tone and volume controls. Housed in attractive cream desk type cabinet. Will match any type of gram input. For operation on 200/250 volts A.C. £6/10/- complete.
This amplifier can be supplied in kit form with cabinet, complete to the last nut and bolt with easy to build point to point wiring diagram for £5/10/-. Suggested speakers for use with the above equipment, a quality 10in. 3 ohm speaker, 22/6, or an extra special quality 12in. 15 ohm speaker, £4/19/6.

MIDGET REVERSIBLE MOTORS. For operation on 4, 6, 12 or 24 volt D.C. Size 2in. x 1¼in., spindle length ¼in. x ¼in. Ideal for model makers, 10/6 each.

MUIRHEAD PRECISION BUILT KEY SWITCHES with heavy contacts. 8 pole 2 way, brand new, 4/6 each.

MULTIWAY TOGGLE SWITCH BOXES. Fitted with 16 toggle type switches. Ideal for train or model control. Brand new and boxed, 9/6 each.

TEST SET TYPE 28. Complete with 50 microamp meter, housed in instrument case with many other useful components, supplied with leads and wooden transit case, 45/- each.

CERAMIC SWITCHES. 3 pole, 4 way, 4 bank, 10/6 each; 4 pole, 3 way, 3 bank, 6/6 each; 7 pole, 2 way, 3 bank, 5/6 each.

ADMIRALTY POWER PACK TYPE PHB. 200/250 volt A.C. input. Output 2,500 volts 10 m/a., stabilised 350 volts 200 m/a., stabilised 110 volts negative 200 m/a., 6.3 volts 10 amp., also containing a complete 6V6 audio output stage and 6in. P.M. Loudspeaker, £5/10/- each.

EX-W.D. POWER PACKS. 230 volt A.C. input. Output 150 volts 60 m/a., 6.3 volts 1½ amps. Fully smoothed, twin metal rectifiers, 29/6 each.

EX-A.M. SWITCH BOXES. Fitted with 3 independent 5 amp. switches, size 3½in. x 2in. x 2in. Ideal for models, cars, boats, etc., 1/9 each. Ditto, 5 way, 3/6 each.

DESK TYPE TELEPHONES. Standard Post Office type, complete with handset and connection block. Circuit and simple instructions available for installation. 42/6 each.

285 POWER PACKS. 230 volt A.C. input, output 2,500 volts 5 m/a., 350 volt 200 m/a., L.T. 6.3 volts. Double choke and paper condenser smoothed. 5U4G and VU120 rectifiers. Ideal as a television power pack. Special price, 69/6 each.

WIRE WOUND POTENTIOMETERS. Midget type, 20 ohm, 750 ohm, 1,200 ohm and 5K. ohm, 2/- each. 3 watts size, 5K. ohm, 10K. ohm, 15K. ohm, 20K. ohm, and 50K. ohm, 2/- each. 100K. ohm, 2/6 each. 6 watts size, 400 ohm, 10K. ohm, 20K. ohm, 3/6 each. 10 watt size, 50K. ohm, and 100K. ohm, 7/6 each.

T.R.1196 RECEIVERS. Complete with 6 valves, 2 of EF39, 2 of EF36, 1 EK32, 1 EBC33. I.F. frequency 465 Kc/s. Simple conversion for complete superhet receiver, 27/6 each.

S.449B POWER PACKS. 200/250 volt input. Output 300 volts 200 m/a. 12 volts 3 amp., fully smoothed, 5U4G rectifier, 62/6 each.

R.F.26 UNITS. Brand new. 50/65 megacycles. 2 of EF54 valves, 1 EC52 valve, Muirhead slow motion dial, 29/6 each.

600-900 MEGACYCLE R.F. UNITS. Set of three types, R.F.116, 118, and 119. £4/10/- complete set. Brand new.

HEAVYBERD AUTO TRANSFORMERS. Brand new, housed in metal case with carrying handle. 200/250 volts input, 100 volts output, 750 watts, £4/10/- each.

HOURS OF BUSINESS: 9 a.m., to 6 p.m. Thursday 1 p.m. Open all day Saturday.

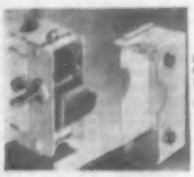
PLEASE PRINT YOUR NAME AND ADDRESS CLEARLY ALSO INCLUDE POSTAGE OR CARRIAGE ON ALL ITEMS.

BARGAINS ! ! VALUABLE UNUSED COMPONENTS

CONDENSERS

CERAMIC VARIABLE CONDENSERS, split stator, plated vanes, spaced .055 ball bearings, butterfly 15/15 P.F, extended spindle. EA. **2/6**

VARIABLE CONDENSERS, 100 pF ceramic insulation. EA. **2/-**



50 PF. VARIABLE CONDENSERS in Screening Case, 3½in. x 1¼in. x 2¼in. Spacing .040. Only EA. **1/-**

CERAMIC TRIMMERS, air spaced silver-plated vanes, 22 pF. Packed in 10s and engine, screwdriver adjustment. DOZ. **5/-**

SWITCHES AND POTS

WAVE CHANGE, 2-wafer 6-pole 3-way Switches. EA. **1/3**

10-AMP. 1-WAY DOUBLE POLE Changing Switches on ½in. Ebonite Base, ex-Admiralty. EA. **9d.**

YAXLEY TYPE 1-pole 6-way Switches, complete, less screws, with knobs. EA. **6d.**

BRAND NEW POTS

POTS, 100K, ¼ spindle ..... EA. **1/-**
POTS, 1 meg., ¼ spindle ..... EA. **1/-**
POTS, 2 gang each, 70K ..... EA. **1/-**
HUNTINGDON POTS, 100 ohm. Miniature wire wound. EA. **2/-**
POTS COLVERN, 200 ohms 5 watts. Wire wound, N.P. case. EA. **2/-**
WIRE WOUND POTS 2,000 ohm 5 watts. E. case. EA. **1/6**
100K MINIATURE POTS ..... EA. **1/-**

OUR STOCKS ARE RAPIDLY DIMINISHING ORDER NOW

RESISTORS

ERIE RESISTORS, 47K, 2-watt, boxed in 50s and 5s. ERIE RESISTORS, 1,200 ohm, ½ watt. Boxed in 50s. 2 watt, 150K. 1 watt, 22K. 1 watt, 70K. 1 watt, price 2 watt, 2d.; 1 watt, 2d.; ½ watt, 1d.

PAXOLIN RESISTOR PANELS with fixing brackets. Size 4in. x 2in. contains 1-10 w. 5K, 2-5 w. 120R, 1-47K., 1-56K, 5w. Brand new. EA. **1/9**

WIRE-WOUND VITREOUS, 10-watt wire ends 500Ω. EA. **9d.**

SLEEVING

SLEEVING, various colours, 1 mm. and 1.5 mm. Permanoid, Paribraid—in coils of 144 yds. Per coil **8/6**

COILS OF NICO FLEX SLEEVING, 1.5 mm. to 2 gross yds. per coil **18/-**

OTHER BRAND NEW ITEMS

MALLORY VIBRATORS. Brand new 6 v. and 12 v., 4-pin. each **4/-**

VALVEHOLDERS, 9D0, Paxolin ..... doz. **4/-**

VALVEHOLDERS, UX5, Amphenol. doz. **5/-**

VALVEHOLDERS, Jumbo 4 pin Ceramic each **2/6**

STAND-OFF INSULATORS only miniature 1 inch. doz. **2/-**

Minimum order for any goods, 5/-. Please add sufficient to cover postage. **Foreign orders—please verify correct parcel post rates from U.K. to country concerned.**

LARGE STOCKS STILL AVAILABLE, ANY QUANTITY SUPPLIED

WOOLLEYS RADIO & ELECTRICAL SUPPLIES LTD.

615 BORDESLY GREEN, BIRMINGHAM 9. Phone: VIC 2078

Z & I AERO SERVICES LTD.,

offer the following equipment:

MARCONI SIGNAL GENERATORS:

Type TF-390G, range 16-150 Mc., unused, in manufacturer's transit cases and with original complement of spares.

Type TF-144G, range 85 kc to 25 Mc., rebuilt as new

Type TF-785B, FM-AM, range 0.4-60 Mc., modulation range 0-25 kc.

"Q" METERS, BEAT FREQUENCY OSCILLATORS, SIGNAL GENERATORS OF ALL TYPES, FREQUENCY METERS, etc.

LABORATORY SUBSTANDARD **VARIABLE CONDENSERS (Govt. Surplus), made by H. W. Sullivan, range 50 to 610 $\mu\mu$F, individually calibrated, brand new, in original cartons. We offer these condensers, invaluable to Laboratories and Amateurs, at an exceptionally low price of.....£0 17 6 Postage 1/6 extra in the U.K.**

Large variety of Aircraft and Radio Accessories.

BRAND NEW AND BOXED:

Headsets HS-38, consisting of two Low Impedance Earpieces ANB-H-1, Cord and plug PL-354, each £0 12 6

Microphones T-17, each £3 10 0

Please write for detailed stock list to:

Z & I AERO SERVICES LTD.,

19, Buckingham St., London, W.C.2

Telephone: TRAfalgar 2371/2

We always buy American Radio Equipment.

RHEOSTATS. 12 v. 1A 2/6. 12 v. 5A 10/6.

MORSE KEYS. Bakelite fully enclosed, 3/6. Ex-W.D.

BENDIX SELSYN TRANSMITTER MOTORS, TYPE VIII A.C. 50 v. 50 cycle, 4in. x 3½in. new. 27/6.

NEW FREQUENCY CRYSTALS. 9100 and 4500 kc., 10/6. 4250-505-4860-2400 Kc. 6/6. ¼in. space pins.

SETS OF 7. CARBON TWIST DRILLS. 1/16in. to ¼in. or 9 1/16in. to ½in. 3/6 set.

PLESSEY T.V. PRE-AMPLIFIER. London band. Valve 6F13. Complete, 25/6.

NEW VR65 VALVES, 5/6, 4 for £1/0/0.

CYLDON 5-CHANNEL PRE-TUNER. Gives 26 D.B. gain. Fit one of these to your T.V. for better pictures. I.F. Output 9.5-14 Mc/s., 15.5-22 Mc/s. With valves EF80, ECC81, 52/6. Less valves, 15/-.

MAINS TRANSFORMERS. Input 200/240 v. Output 350-0-350 or 250-0-250 volt 80 mA., and 4 and 6.3 v. 4 a. and 4 and 5 v. 2 a. Price 21/6. Input 200/240 v. Output tapped 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30 volts, 2 amp., 21/6. Output 17-11-5 volts 5 amp., 22/6. Output 17-11-5 volts 1½ amp., 16/6. 6.3 v. 2½ a., 8/6. All with one year's guarantee.

D.P.D.T. RELAYS. Operate at 200/300 volts D.C. 8/6. We can supply any type of voltage and contacts at varying prices.

NEW SELENIUM RECTIFIERS. F.W. 12/6 volt 3 amps., 14/6; 4 amp., 22/6; 6 amp., 30/-; 1 amp., 8/6; 12 v. 100 mA., 3/-; 24 v. 2 amp., 30/-; H.W., 250 v. 100 mA., 9/-; 250 v. 275 mA., 17/6; 250 v. 60 mA., 6/6.

GERMANIUM or SILICON CRYSTAL DIODES, 3/9.

M.C MICROPHONES with matched Trans., 15/6.

FLS FILTER UNITS, 8/6. Same as FL8 but less switch.

TR1196 TRANSMITTER SECTION. New and complete but less valves. 4.6-6.8 Mc/s. Easily converted, 15/-. With valves TT11, EL32, EF50, £2

L.R. ARMY HEADPHONES, 9/6.

TIME DELAY RELAYS. We specialise in units giving varying time constants. **Please send us your requirements or problems.**

FISHING ROD AERIALS. Set 3—12ft., 7/6. RUBBER BASES, 3/6.

P.O. VEEDER COUNTERS 0-9999, 24/50 volts D.C., 15/6.

0-5 AMP. METERS. 2½in. sq., 11/-.

POCKET VOLTMETER. 2in. M/C. 0-20-200, 11/6.

U.H.F. AERIALS, complete with base, 180-200 mc/s., 6/6

BUZZERS, variable pitch, ex-R.A.F., 12/24 v. A.C./D.C., 3/6.

All Carriage paid in the U.K. from Dept. W.W.

TR1196 COMPLETE TRANSMITTER AND RECEIVER, Rack mounted with 24v. power unit ready for use £6/10/0 carr. paid.

AR88LF in tip-top condition, £35. Carriage extra.

THE RADIO AND ELECTRICAL MART

253B PORTOBELLO ROAD, LONDON, W 11

Phone: PARK 6026

CONSTRUCTOR'S BARGAINS!

RF UNITS TYPE 26 and 27. For use with the R.1355 or any receiver with a 6.3 v. supply. These are the variable tuning units which use 2 valves EF54 and 1 of ECS2. Type 26 covers 65-50 Mc/s (5-6 metres) and Type 27 covers 85-65 Mc/s (3.5-5.0 metres). Complete with valves, and BRAND NEW IN MAKER'S CARTONS. ONLY 35/- each.

" PYE " 45 MC/S I.F. STRIP. Ready made for London Vision Channel, this 5-stage strip contains 6 valves EF50 and 1 EA50. Supplied with circuit and details of very slight mods. required. BRAND NEW, ONLY 7/6 or less valves 5/-.

I.F. STRIP 194. An easily modified strip recommended for T.V. constructors who want good results at moderate cost, or for those who have built televisors but are having trouble in the sound or vision receivers. Size 18in. x 5in. x 5in., it is complete with 6 valves VR65, 1 of VR92, and 1 of VR56 or VR53. Mod. data supplied. ONLY 45/- (postage, etc., 2/6). Less valves, 19/6 (post, etc., 2/6).

TELESCOPIC AERIAL. Pulls out of metal tube 15in. long to extend to 73in. BRAND NEW, ONLY 7/6 (postage 10d.).

AMPLIFIER 208. Ideal for conversion into a high gain TV pre-amp. Complete with 2 valves EF50. ONLY 15/- (postage, etc., 1/6).

INDICATOR TYPE 95. Built on a two-deck chassis, this contains VCR97 tube with mu-metal screen, 16 valves SP61, 4 of EA50, and 2 of EB34 and also shoals of components. ONLY 59/6 (carriage, etc., 7/6).

INDICATOR UNITS, TYPE 6. Contain VCR97 Tube with mu-metal screen, 4 valves EF50 and 2 of EB34. NEW CONDITION. ONLY 59/6 (carriage, etc., 7/6).

INDICATOR 233 CHASSIS. Similar to the type 6 Indicator Unit. This contains VCR97 CRT holder, 11 valve holders, resistors and condensers, etc. In excellent condition. ONLY 10/- (carriage, etc., 5/-).

AMERICAN 12 v. DYNAMOTORS. Output 255 v. 60 mA. Ideal for car radio or running electric shaver from car battery. ONLY 22/6.

24 v. BLOWER MOTORS. ONLY 12/6.

6 v. VIBRATOR UNITS. Made by the National Co. of America for use with H.R.O. Communications Receivers, supplying 165 v. at 85 mA. fully smoothed D.C. Complete with vibrator and 6X5 rectifier in black crackle cabinet size 7in. x 7½in. x 6in., only 39/6 (postage, etc., 2/6).

CRYSTALS. British Standard 2-pin 500 kc/s., 15/-. Miniature 200 kc/s. and 465 kc/s., 10/- each.

SPEAKERS. P.M., 6½in., less trans 19/6; 8in. less trans. 19/6; 10in. with trans. 27/6 (postage 2/- ea.)

CHOKES. 10H 60 m/a., 4/-, 5H 200 m/a. 7/6, 20H 120 m/a., 10/6 (post 1/- ea.)

COMMUNICATIONS RECEIVER R.1155

The famous ex-Bomber Command Receiver known the world over to be supreme in its class. Covers 5 wave ranges: 18.5-7.5 Mc/s., 7.5-3.0 Mc/s., 1,500-600 kc/s., 500-200 kc/s., 200-75 kc/s, and is easily and simply adapted for normal mains use, full details being supplied. Aerial tested before despatch. BRAND NEW AND UNUSED IN MAKER'S TRANSIT CASES, ONLY £11/19/6.
SLIGHTLY USED RECEIVERS, Grade 1, also tested working before despatch, £9/19/6.
SECONDHAND, good condition, aerial tested before despatch, £7/19/6.
A.C. MAINS POWER PACK OUTPUT STAGE, in black metal case, enabling the receiver to be operated immediately, by just plugging in, without any modification. Can be supplied as follows, WITH built-in 6½in. P.M. Speaker, £5/10/-, LESS speaker, £4/10/-.
DEDUCT 10/- IF PURCHASING RECEIVER AND POWER PACK TOGETHER.
Please add carriage cost of 10/6 for receiver and 5/- for Power Pack.

POWER UNIT TYPE 3

Made for use with the R.1132A, this is a standard rack mounting job to match the receiver, and is for 200/250 v. 50-cycle mains with outputs of 250 v. D.C. 100 mA., and 6.3 v. 4 amps. Fitted with H.T. current meter and voltmeter, this is a first-class unit, and can be used for a variety of receivers. Used, but tested working before despatch. ONLY 90/- (carriage, etc., 5/-). Connecting Cable with Jones Plugs for receiver and power unit, 10/-.

AMERICAN LORAN INDICATOR UNIT APN.4. The unit recommended as a basis for the " WIRELESS WORLD " TELEVISION OSCILLOSCOPE, copy of which is supplied, contains 5CP1 CRT and screen. 14 valves 6SN7, 3 of 6SL7, 8 of 6J46, 1 of 6SJ7, 100 kc/s. crystal, and hundreds of condensers, resistors, etc., etc. BRAND NEW IN MAKER'S TRANSIT CASES. ONLY £6/19/6 (carr., etc., 15/6).

METERS

F.S.D.		SIZE AND TYPE	PRICE
1 milliamp.	D.C.	2½in. Flush circular	21/6
1	D.C.	2½in. Desk type	25/-
5	D.C.	2in. Flush square	7/6
100	D.C.	2½in. Flush circular	12/6
150	D.C.	2in. Flush square	7/6
500	thermo	2in. Flush square	5/-
500	thermo	2in. Proj. circular	5/-
20 amps.	D.C.	2in. Proj. circular	7/6
40 amps.	D.C.	2in. Proj. circular	7/6
30-0-30 amps.	D.C.	Car type moving iron	5/-
15 volts	A.C.	2½in. Flush, circ., mov. iron	8/6

All meters Brand New in Maker's Cartons.

100 MICROAMPS METERS

2½in. circular flush mounting. Widely calibrated scale of 15 divisions marked " yards " which can be rewritten to suit requirements. These movements are almost unobtainable today and being BRAND NEW IN MAKER'S CARTONS are a snip at ONLY 42/6.

HOUR METERS. For checking running time of equipment. Operates from normal 50 cycles mains. BRAND NEW IN MAKER'S CARTONS. ONLY 39/6.

MODEL MAKER'S MOTOR. Reversible poles. Only 2in. long and 1¼in. diameter, with ¼in. long spindle. Will operate on 4, 6, 12 or 24 volts D.C. ONLY 10/6.

TR1196 TRANSMITTER SECTION. In perfect condition, less valves. ONLY 7/6 (postage, etc., 2/6).

159 RECEIVER UNIT. Contains 1 each valve, types EF50, EA50, SP61, RL37 and 24 v. selector switch. ONLY 12/6.

VACUUM PUMPS. For Handymen and Model Makers. Ex-R.A.F. Type 83. BRAND NEW IN MAKER'S CARTONS. ONLY 22/6 (post 2/-).

TRANSFORMERS. Manufactured to our specification and fully guaranteed. Upright mounting, fully shrouded, normal primaries.
425 v.-0-425 v. 250 mA., 6.3 v. 4 a., 6.3 v. 4 a., 5 v. 3 a., 50/-.
350 v.-0-350 v. 160 mA., 6.3 v. 6 a., 6.3 v. 3 a., 5 v. 3 a., 42/6.
350 v.-0-350 v. 150 mA., 6.3 v. 5 a., 0-4-5 v. 3 a., 32/6.
250 v.-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., 32/6.
250 v.-0-250 v. 60 mA., 6.3 v. 3 a., 5 v. 2 a., 21/-.
Please add 2/- per transformer postage.

TRANSFORMERS, FILAMENT. 6.3 v. 2 a., 7/6 (postage 1/-).

TRANSFORMERS, EHT. Upright mounting.
EHT for VCR97 Tube 2,500 v. 5 mA. 2 v.-0-2 v. 1.1 a., 2 v.-0-2 v. 2 a., 37/6.
EHT 5,500 v. 5 mA., 2 v. 1 a., 72/6.
EHT 7,000 v. 5 mA., 2 v. 1 a., 82/6.
EHT 7,000 v. 5 mA., 4 v. 1 a., 82/6.
Please add 2/- per transformer postage.

MODULATOR TYPE 67. Contains fully smoothed normal A.C. Mains Power Pack, transformer being 345 v.-0-345 v. at 200 mA., 6.3 v. 5 a., 6.3 v. 250 mA., 5 v. 2 a., 6 valves SP61, 3 of EA50, 2 of EB34, and 1 of SZ4. BRAND NEW IN MAKER'S CASES. ONLY 67/6 (carriage 7/6).

MU-METAL SCREEN FOR VCR97 TUBE, etc., ONLY 8/6.

CABLE. CLEARANCE OFFER of 23/36 twin polythene. Weatherproof, and suitable for outdoor use, 39/6 per 100 yard coil (carriage, etc., 3/6). S.A.E. for sample, trade enquiries invited.

SPECIAL OFFER. Ex-Admiralty L.T. TRANSFORMER. Normal mains input, output 4 v. 20 amps. C.T. New and unused, these have become damaged, but are still usable, the damage being confined to broken fixing lugs, and/or broken bakelite terminal panels. Formerly sold at 30/-, now offered at 17/6 (post, etc., 2/6).

ROTARY POWER UNIT, Type 87. Ex-R.A.F. Input 24 v. Output 230 v. 65 mA., and 6.3 v. 2 amps. Fully filtered, smoothed, and noise suppressed. Ideal for running radio on boats or other 24 v. D.C. source. BRAND NEW. ONLY 15/- (postage, etc., 2/6).

INTERNATIONAL OCTAL PLUG Fits into I.O valveholder 2/- (post 3d.).

GANGED POTENTIOMETERS. Double 50K and double 1 meg., 7/6 each.

CERAMIC 2-WAY 3-BANK SWITCHES, 7/6 each.

Cash with order please, and print name and address clearly

U.E.I. CORPORATION

Radio Corner, 138, Gray's Inn Road, London, W.C.1. *'Phone:* TERMINUS 7937

(Open until 1 p.m. Saturdays. We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by bus from King's Cross)

A new edition of an invaluable reference book

RADIO LABORATORY HANDBOOK

M. G. Scroggie, B.Sc., M.I.E.E.

6th Edition

This well-known practical work describing laboratory equipment and methods of operation has now been entirely re-written and greatly enlarged. Among the subjects considered are layout and furnishing of premises, methods of measurement, sources of power and signals, indicators and other instruments and circuit and signal measurements. There is a comprehensive references section, and the text is supplemented by many photographs, diagrams, graphs and tables.

25s. net BY POST 26s. 3d.

8¼in. × 5¼in. 460 pp.

Available from booksellers or direct from :—

Iliffe & Sons Limited, Dorset House, Stamford Street London, S.E.1

MIDLAND INSTRUMENT CO.

POWER SUPPLY UNITS No. 5, complete except for the 6-v. accumulator, consists of the 6-v. 5-amp. hand generator, with cut-out, 6-v. input vibrator pack, provides all L.T. and H.T. outputs for the 18 and 38 sets, spare Mallory vibrator, bakelite accumulator box, etc., etc., in metal back carrying case, complete with belt and shoulder webbing, new in sealed cartons, 40/-, carriage 6/-; Scot. 7/6; N.I. 10/-.

CHARGING KITS, consists of a G.E.C. 1½-amp. full-wave rectifier, and a Douglas 200/250-v. A.C. input transformer, specially wound for this rectifier, with requisite voltages to charge a 2, 6 or 12-v. battery at 1½-amps., 2 high grade components, complete with circuit diagrams and instructions, brand new, 25/-, post 1/6.

G.E.C. MINIATURE RELAYS, all contacts are platinum, and relays are brand new boxed, 5,000-ohms, 2-pole change-over, hermetically sealed, 10/-, post 6d. Ditto, 5,000-ohms, 2-pole change-over 50-1 2-pole make before break, hermetically sealed, 12/6, post 6d. Ditto, 40-ohms, 4-pole change-over, open type, 5/-, post 6d.

G.E.C. TYPE 600 RELAYS, brand new and boxed, 75-ohm, 2-pole heavy-duty make and 1-pole change-over, 5/-, post 6d. Ditto, 150-ohms, 2-pole heavy-duty make, 5/-, post 6d. Ditto, 5,000-ohms, 1-pole make and 1-pole make before break, 7/6, post 6d. Ditto, 7,000-ohms, 1-pole make, 6/-, post 6d.

U.S. RELAYS, Leach pattern, 200-ohm, 2-pole changeover, 1/6, post 4d., 15/- doz., post 1/9, ditto 3-pole changeover, 1/9, post 6d., 18/- doz., post 2/-.

BUZZERS, 3-6-v. high note, platinum contacts, variable note control knob, high grade type, worth 40/-, our price, new unused, 5/-, post 1/-.

ELECTROLYTIC CONDENSERS, 32-mfd. 450-v. D.C., by Smith, Mismould, etc., new and guaranteed, cartons of 12 condensers, 10/-, post paid.

PROJECTION UNITS, consists of an optical mount, fitted with a bloomed f/3.2 Achromatic lens, 3½in. focal length, at one end, also a convex/concave ground glass at the other, attached to an enclosed lamphouse, fitted with a 24-v. 15-watt lamp, and polished reflector, fraction of original cost, 10/-, post 1/-.

VARIABLE RHEOSTATS, wire-wound on ceramic, 50-ohms at 1-amp., laminated wiper arm, Bakelite knob control, in diecast cases size 5½in. × 4½in. × 2½in., fitted on/off toggle switch and 2 cannon plugs, new, boxed, 7/6, post 1/6.

SELSYN TRANSMITTERS (Magslips), 3in. type, pure synchro 2-y-1-2-3, suitable as master or slave, 26-v. 50-cycle single phase A.C. operated. When two or more of these are wired up, the rotation by hand (or other means) of one, will result in a 100 per cent. follow in the other(s), both clockwise or anti-clockwise, supplied brand new with test report, in tropicalised sealed cartons. Value, £5 each, our price 25/-, post 2/-, 2 for 50/-, post paid with wiring diagram. **SIEMEN'S HIGH SPEED RELAYS** coil res. 140 ohms, single-pole changeover platinum contacts, adjustable armature tension and contact gap, well worth 25/-, our price, new, unused, 5/-, post 6d., 50/- doz., post 2/-.

TELEPHONE SETS, consists of 2 combined receivers and microphones, connected by 25ft. twin flexible, provides perfect 2-way communication up to 1 mile with extra flex), self-energised, no battery required, complete ready for use, new, boxed, 12/6, post 1/-.

CRYSTAL SET COILS, high-gain dual range med. and low, complete with crystal set circuit, 2/6, post 4d.; Variable conds. .0005 mfd., Bakelite dielectric, complete with pointer knob, 3/6, post 6d.; Germanium detector, latest wire-ended type, 2/-, post 3d.; Wavechange switches, 2/6, post 3d.; Clix plugs with sockets, 4 sets 2/-, post 4d. All items to construct a crystal set, 10/-, post paid.

Many other bargains; send 3d. with S.A.E. for current lists.

MIDLAND INSTRUMENT CO., MOORPOOL CIRCLE, BIRMINGHAM, 17

Tel. : HAR 1308

BC610 TRANSMITTERS with speech amplifier, aerial tuning unit, etc. Brand new.

RCA TRANSMITTERS Type **ET-4336.** Complete with original speech amplifier, crystal multiplier and VFO units. Unused and reconditioned. Can be supplied with very large quantity of spares.

RCA TRANSMITTERS. Type **ET-4332** modified by R.A.F for use on crystal or master oscillator. Complete with speech amplifier.

MULTI CHANNEL TRANSMITTER T-4/FRC, with modulators MD-1/FRC, 2 Mc/s to 18 Mc/s. Each channel 400 w. output.

W.S. No. 19 & 20 both complete with installation kit. Tropicalised. New.

MAGNETO 10 LINE U.C. TELEPHONE SWITCHBOARDS (complete).

MARCONI SIGNAL GENERATORS Type T.F. 144G. As new, checked.

A.R.88D's, A.R.77's, 927's, HRO, BC.312, BC.342, R.109 and others.

METAL RECTIFIERS Type 1B, D.C. output 10 amps at 22 v. input 220/250 v., 50 c/s.

All above items in excellent working condition.
Working demonstration upon request.

SPARES A large selection available for SCR399 (BC610), ET4336, SCR610, EE8 Telephones, and Teleprinters type 7B.

TX VALVES 805, 807, 813, 861, 66A, 100TH, 250TH, and many others.

Large stock of Tx condensers, crystals and other components. Alignment and repair of communication receivers and all other short-wave equipment undertaken.

P.C.A. RADIO

New Address, Offices and Works

BEAVOR LAKE, HAMMERSMITH, LONDON, W.6

Telephone : RIV 8006 7

Henry's
RADIO COMPONENTS
ELECTRONIC & TELEPHONE EQUIPMENT
(RADIO LTD.)

5 Harrow Road, Paddington, W.2

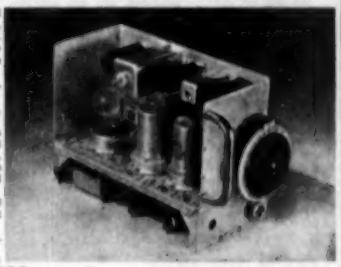
PADdington 1008/9 and 0401

OPEN MONDAY to Sat. 9-6. THURS. 1 o'clock.

SEND STAMPS FOR NEW 1955 28-PAGE CATALOGUE

"R.F. 26" F.M. CONVERTOR UNIT—88/100 Mc/s

We can now offer this self-contained Unit Comprising 6 Valves—2-6BA6, EB91, VR137, EF54, EF54. Two I.F. stages and separate local oscillator, also Muirhead graduated vernier drive, assuring easy tuning.



COMPONENTS OFFERED TO COMPLETE F.M. UNIT.

- New RF26 Unit with 3 valves, VR137, EF54, EF54, £1/15/-.
- Complete set of all components for conversion including 2 6BA6 and EB91, tuning condenser, I.F.T.'s Osc. and coils. Resistors and fixed condensers, plugs, wire and tag strips, £4/12/6.
- Instruction Book with technical circuit and complete lay-out diagrams, 2/6.
- Voltage required 250 v. 50 mA. 6.3 2 amps.
- Special offer of all above items and RF26, including circuit, £6/5/0, postage 3/-.

ALL ITEMS SOLD SEPARATELY.

- Charge for alignment when completed 7 6
- Assembled, aligned and ready for use £8 10 0

Call for demonstration.

RADIO-GRAM CHASSIS

3 Wave-band Superhet. Med., long and short.

5 Latest Type MULLARD Valves.

4 Position Switching. Gram., mad., long and short.

Provision for Extension Speaker. A.C. Mains. 110/250 volts.

Chassis 11in. x 7in. x 2½in. Scale 8in. Square. Or Chassis 13½in. x 6½in. x 2½in. Dial 10in. x 5½in. PRICE £10/5/-.

BRAND NEW AND GUARANTEED. CARR. PACKING AND INS. 10/-.

G.E.C. RECORDING TAPE

600ft. Reels 10/-

EF50 (VR91A)

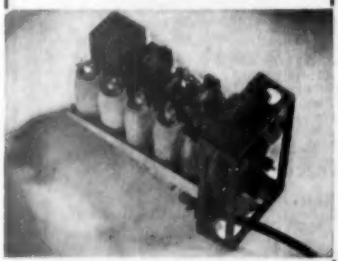
The selected EF50, Red Sylvania, original boxes 10/- each, 90/- for ten.

PYE 45 Mc/s. STRIP TYPE 3583 UNITS

Size 15in. x 8in. x 2in. Complete with 45 Mc/s. Pye Strip, 12 valves 10 EF50, EB34 and EA50, volume controls and boxes of Resistors and Condensers. Sound and vision can be incorporated on this chassis with minimum space. New condition. Modification data supplied. Price £5. Carriage paid.

SPECIAL OFFER

"38" WALKIE TALKIE SETS



(CASE REMOVED FOR ILLUSTRATION)

We have purchased large quantity of the above "38" Sets, and can now offer same complete with 5 valves 4-VP23 and ATP4, Throat Microphone, Headphones, Junction Box and Collapsible Aerial in absolutely new condition and guaranteed Air Tested. Freq. range 7.4 to 9 Mc/s. Range approx. 5 miles.

59/6 CARR. 5/-

"426" CONTROL UNIT

Containing 4 EF50, 2 SP61, 2 EA50, 1 EB34, 2-single-gang .0005 tuning condensers. W/W volume/controls switches, condensers and resistors. Size 12in. x 9in. x 5in. New condition. 35/-, carr. 3/-.

14 WATT HIGH FIDELITY F.M. AND RECORD AMPLIFIER

200/250 volts A.C. First Quality Components only. Stewart Transformers and Chokes. Partridge Output Transformer. Bass and Treble Controls (Boost and Cut). Supply Socket for Tuner Unit. Ideal for Denco F.M. Feeder. 5 valves—4SN7, 6SL7, 6L6, 6L6, 5Z4. Complete ready for use.

BARGAIN PRICE £17-10-0.

T.C.C. .1 mfd. 5/7,000 v. wkg., type CP58QO, Bakelite case, 7/6 each. .5, 1, 2 2,500 v. wkg., 4/-.

EXTRA SPECIAL VALUE IN MIDGET TYPE ELECTROLYTICS

Metal tubular wire ends with cardboard sleeves

8 mfd., 450 v.	2/-
16 mfd., 450 v.	3/-
8 + 8 mfd., 450 v.	3/6
16 + 8 mfd., 450 v.	4/6
16 + 8 mfd., 350 v.	5/6
32 + 32 mfd., 450 v., 3 x 1½in.	6/-
16 + 16 mfd., 450 v., 3 x 1½in.	5/-
60 + 40 mfd., 350 v., 4½ x 1in.	5/-
8 mfd., 500 v., black, 3 x 1½in.	2/-

U.S.A. INDICATOR UNIT Type BC929A

These Units are in absolutely new condition. In black crackle cabinet 14½in. x 8in. x 8in. Complete with 3 RF1 C/R Tube, Shield and Holder. 2-6SN7GT, 2 6H6GT; 1 6X5GT; 1 2X2; 1 6J6, V/controls, condensers, etc. Ideal for scope. 65/- Carr. & Packing 5/-.

MORSE PRACTICE KIT

Complete with buzzer, morse tapper and battery compartment on baseboard, 6/-, post paid.

CRYSTALS

200 kc/s, 2 pin, U.S.A.	10/-
465 kc/s, 2 pin, U.S.A.	10/-
500 kc/s, 2 pin, British	15/-

Holders for U.S.A. Types 1/6.

RCA 931A PHOTO-ELECTRIC CELL AND MULTIPLIER.

For facsimile transmission, flying spot telecine transmission and research involving low light-levels, 9-stage multiplier. Brand new and guaranteed, only £2/10/-. Special 11-pin base 2/- Data sheets supplied.

TUNING CONDENSERS

.0005 Midget 2½ x 1½ x 1½in.	5/-
.0005 Midget 2½ x 1½ x 1½in., with trimmers	6/6
.0005 Standard Size, with trimmers	7/6
.0005 with 4-way push-button assembly	7/6

NEON INDICATOR LAMP

Siemens type V1132. Diameter 1½ x ½in. Striking volts 80 v. S.P.B.C.

2/6 post free.

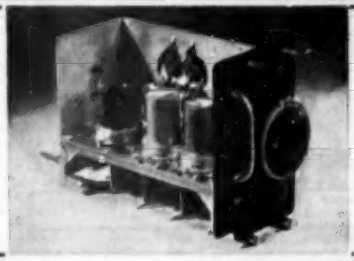
INDICATOR UNIT TYPE 182A

Unit contains VCR517 Cathode Ray 6in. tube, complete with Mu-metal screen, 3 EF50, 4 SP61 and 1 5U4G valves, 9 wire-wound volume controls and quantity of resistors and condensers. Suitable either for basis of television (full picture guaranteed) or Oscilloscope. Offered BRAND NEW (less relay) in original packing cases at 67/6. Plus 7/6 carr. "Radio-Constructor" 'scope circuit included.

R.F. UNITS

Type 24
20-30 Mc/s.
Switched Tuning.
With 3-SP61
15/- EACH
BRAND NEW

Type 25
40-50 Mc/s.
Switched Tuning.
With 3-SP61
19/6 EACH
BRAND NEW



R.F. UNITS

Type 26
50-65 Mc/s.
Variable Tuning.
2—VR136 1—VR137
35/- EACH
BRAND NEW

Type 27
60-80 Mc/s.
Variable Tuning.
2—VR136 1—VR137
35/- EACH
BRAND NEW

T.V. PRE-AMPLIFIER FOR LONDON AND BIRMINGHAM. Complete with 6AM6. Ready to plug into your set, 27/6. P. P. 2/6.

CRYSTAL MICROPHONE INSERTS

8/6 POST FREE

8/6 POST FREE

Ideal for tape recording and amplifiers. No matching transformer required.

CATHODE RAY TUBES

VCR139A. 2½in. C/R Tube. Brand new in original cartons (carr. free)	£1 15 0
VCR97. Guaranteed full T/V picture (carr. 5/-)	£2 0 0
VCR517C. Guaranteed full T/V picture	£1 15 0
MU-METAL SCREENS for VCR97 or 517. P.P. 1/6	10 0
6in. ENLARGER for VCR97 or 517. P.P. 1/6	17 6

VCR97 15/-. Carr. 2/-. Brand new and crated—slight cut-off—ideal for 'Scopes. Limited quantity.

PHOTO CELLS G.S.1 Brand new, 5/-

PLEASE ADD POSTAGE. ARTICLES UP TO 10/-, 1/-. £1, 1/6. £2, 2/-.

RADIO TRADERS LTD.

23 WARDOUR ST., LONDON, W.1. (Coventry Street end)
Phone No. GERrard 3977/8 *Grams: "Radiotrade"*

PAXOLIN SHEET

18in. x 4½in. x 1/16in.	1/- each	10in. x 10in. x 1/16in.	1/6 each
20in. x 10in. x 1/16in.	1/6 each	20in. x 10in. x 1/16in.	3/- each

CONDENSERS Per doz.

16 Mfd., 200 v., 1/3 each 12/-
16 Mfd., 375 v., 2/- each 21/-
16 x 8 Mfd., 350 v., 1/6 each 15/-
16 x 16 Mfd., 350 v., 2/6 each 27/-
16 x 24 Mfd., 350 v., 2/6 each 27/-
16 x 32 Mfd., 275 v., 1/6 each 15/-
20 x 20 Mfd., 275 v., 2/6 each 27/-
24 Mfd., 350 v., 2/- each 21/-
24 Mfd., 450 v., 2/3 each 24/-
32 x 8 x 8 Mfd., 275 v., 1/9 each 18/-
50 Mfd., 12 v., 1/- each 10/6
100 Mfd., 6v., 10d. each 8/-
1 Mfd., 400 v. Metal Cans, 1/- each 10/6
Condenser Clips for above 3/6
Large Assortment Tubular Condensers 4/-
MIDGET MICA CONDENSERS: .0001, .0002, .0003, .0004, .0005, 4/-
200 Assorted Moulded Micas. Popular Values £2 10 0
200 Assorted Silver Micas. Popular Values £2 10 0
200 Assorted Carbon Resistors: ¼, ½ and 1 watt. Good selection £1 10 0

SPECIAL OFFER

0.1 12,000 volts D.C. test Mansbridge Condensers, Height 6¼in. Width 3¼in. Depth 2¼in. Fixing centres 4in. **Price 5'6** + postage 1/-

Special prices for quantity.

CARBON RESISTORS: ¼ watt 2/6; ½ w. 3/-; 1 w. 4/-; 2 w. 6/- per doz.

HIGH STABILITY RESISTORS:

Tolerance:	1%	2%	5%	
¼ watt	1/-	9d.	6d.	each
½ watt	1/3	1/-	9d.	each
1 watt	1/9	1/6	1/3	each

C.O.D. preferred for resistor orders as we cannot guarantee to stock all values.

8-40 MEG 2 watt 2/6 each

PYE PLUGS AND SOCKETS 1/6 pair

WW AND VITREOUS RESISTORS. 5 watt, 1/6; 10 watt, 2/6; 15 watt, 3/-; 20/30 watt, 3/6 each

WW V/CONTROLS. COLVERN and B-NSF. 5K PRESET and other values, 2-3 watt. 2/- each. 10K Isolated Spindle..... 2/-
500 ohms, 1K, 20K, 25K, 50K, with spindle 3/-

V/CONTROLS WITH SWITCH: most values, B-NSF 2/6

V/CONTROLS: Less Switch, Preset and Spindle. MOST VALUES 1/9

METERS 0-300 mA 2½" Flush Mounting 8/6 each
0-500 mA 2½" Flush Mounting 10/6 each

TWIN MIDGET GANGS, .0005, with trimmers, PERSPEX COVER 5/6

4-WAY PUSH BUTTON UNITS, 2/6 each 20/- doz.

PUSH BUTTON KNOBS 3/- ,,

TAG STRIPS: 3-way 2/- doz.; 4-way 2/6 doz.; 5-way 3/- doz.; 7-way 4/- doz.; 28-way 12/- doz.

POINTER KNOBS. Small black, with line, ¼in. hole 7/6 ,,

WANDER PLUGS, Red and Black 2/- ,,

PHILIPS TRIMMER TOOLS 1/- each

BELLING & LEE. P/M FUSE HOLDERS. Type L354 2/6 ,,

WEARITE COILS: Types PA4, PO4, PA5, PO5, 1/3 each 12/- doz.

VALVE HOLDERS: Moulded. **B9A, 7/6; B7G, 6/-; EF50,** Pax., 6/-; **EF50,** Ceramic, 9/- per doz.; **ENGLISH OCTAL,** 3/- per doz. **SCREEN CANS** for B9A, B7G, 6/- doz.; **PAXOLIN** — B7G, MAZDA 4-pin UX 3/- ,,
Valveholders fitted with lower screens to accommodate cans, 1/6 per doz. extra.

BELLING & LEE PLUGS AND SOCKETS. Ex-Govt. BRAND NEW. 5-pin, 1/6; 7-pin, 1/9; 10-pin 2/6 pair

BULGIN. P74, Plug and Socket, 2/6; P200, Plug and Socket, 2/-; Rotary Switches, S.255, 2/-; Dolly Switches, S.267, 2/-; Standard Switches, Ex-Govt., On-off 1/6 each

POST OFFICE LAMP JACKS, No. 10, 1/- each 9/- doz.
Lamp Covers for same 3/- ,,

WESTINGHOUSE KHI HALF WAVE RECTIFIER. Rating 3.6 v., or 10 mA., 3/6 each; 36/- per doz.

OUTPUT TRANSFORMERS. Multi Ratio, 5/-; Pentode or Power 4/- each

VALVE SCREEN CANS for Standard Valves, 1/- each 10/6 doz.

DRUM DRIVES, 4in. 1/- each

WESTECTORS, WX6, WX12, W1, W12, W4, 1/- each 9/- doz.

ARCOLETRIC (Whitney Lamp). Red, green, clear, 1/6 each 15/- ,,

SIGNAL LAMP HOLDERS P/M, complete with adjusting lamp holders, 1/9 each 18/- ,,

AIR SPACE TRIMMERS. Preset and spindle types, 5PF, 10PF, 15PF, 20PF, 25PF, 50PF, 75PF, 1S/-; 100PF Preset, 1/6 each 15/- ,,

JONES PLUG AND SOCKETS. 4-pin, 2/6; 6-pin, 3/-; 8-pin, 3/6; 10-pin, 4/-; 12-pin 6/- pair

NUTS, 8BA, 3/-; 6BA, 2/6; 4BA, 3/-; 2BA 4/- gross

SOLDER TAGS, 2/6 gross. **SHAKEPROOF WASHERS** 2/- ,,

WASHERS, 2, 4 and 6BA 1/- ,,

SHAKEPROOF SOLDER TAGS, 4BA and 6BA, 3/-; 2BA. 2/9 ,,

CASH WITH ORDER OR C.O.D. **ALL ORDERS DEPT. W.1**
ALL ORDERS FOR LESS THAN £1 ADD POSTAGE

We invite your enquiries for items not listed.

Trade Counter open 9 to 6 Monday to Friday.
Callers Welcomed.

WHOLESALE, MANUFACTURERS' AND EXPORT ENQUIRIES INVITED

HANNEY of BATH offers:

OSRAM 912 Erie resistor-pot, kit with ceramic tube resistors, very highly recommended, 23/6; Lab resistor kit, 32/4; T.C.C. condensers, 85/-. **PARTRIDGE** Components, with loose lead terminations, Mains trans., 44/-; Smoothing Choke 29/6; Output trans, 76/9. Price includes Partridge carriage/packing charge. Printed panel, 14/6. W.B. chassis, 34/9. Send for complete list.

MULLARD 5 VALVE, 10 WATT AMPLIFIER. T.C.C. Condensers, 45/-; Erie resistor-pot, kit, 37/6; Elstone Mains trans., 36/-; Elstone Output trans., 45/- (both types); Denco chassis, 12/6. Small parts as per our list. Matched pairs of valves are available for both the above designs.

WILLIAMSON AMPLIFIER. Woden potted components. Output trans. WOT.25 (1.7 Ω), 130/-; PTM 14 s. mains trans., 87/6; PCF.12 150 mA. choke, 44/-; PCF.22 30 H. 20 mA. choke, 30/-; PTM 22 (mains trans. for pre-amp.), 47/6. Resistor (RK), and Condenser kits (CK) available, RK, main amplifier, 29/6; RK figs. 12 and 27, 12/6; RK fig. 13, 28/9; RK fig. 19, 36/-; RK fig. 29, 29/3; CK fig. 13, 15/-; CK fig. 15, 47/-; CK fig. 19, 54/6; CK fig. 27, 19/-; CK fig. 54/6. 12 1% silver mica (fig. 19), 15/-; 7 5%, 7/-. Elstone output trans., 90/-; mains trans., 57/6; 1 OH 150 mA. choke, 20/-; 30 H. 20 mA. choke, 10/-.

HIGH FIDELITY SPEAKERS. W.B. HF810, 60/6; W.B. HF912, 67/-; W.B. HF1012 (3, 7.5 and 15 ohm. coil), 77/6. G.E.C. type FR metal cone, 63.15/-. Goodmans "Orlin 111," £9.15/-.

COILPACKS. DENCO, CP 4/L and CP 4/M, 33/4; CP 3/370 pf. and CP 3/500 pf., 42/8. OSMOR "Q" HQ, 48/-; LM, 40/-; Batt., 50/-; TRF, 40/-; HF stage for HQ pack, 20/-; ETA 4-station pack, 43/8. We stock COILS by Weymouth, Osmor Wearite, Denco, Teletron and R.E.P.

WIDE ANGLE COMPONENTS. ALLEN. Teleking Chassis, 50/-; Colletts (TK and Super-Visor), 44/6; LO.308, 40/-; PO.305, 21/-; DC.300c., 29/6; PC302, 31/-; GL.18 and 18, 7/6 each; SC.312, 21/-; AT.310, 30/-; OP.117, 9/-; RT.314, 15/-; DENCO Chassis Magnaview, 37/6; Chassis, Super-Visor, 51/6; Colletts Magnaview, 41/6; WA/DCA1, 43/-; WA/PCA1, 31/-; WA/LCI and WC1, 7/6 each; WA/FMA1, 21/-; WA/LOT1, 42/-; WA/FBT1, 16/-.

Send 6d. stamps for our General List of components for Viewmaster, Soundmaster, Williamson Amplifier, Teleking, Magnaview (Brimar and English Electric large screen TV), Super-Visor, Mullard Universal, Close tolerance Silver Micas, etc., etc. Please add 1/- postage to orders under £2.

L. F. HANNEY
77 LOWER BRISTOL ROAD, BATH
Tel. : 3611

SPECIAL CLEARANCE SALE—
GREAT BARGAINS FOR CALLERS

MULTI-RANGE TEST METERS BY PRECISION, U.S.A. 60 Micro/amp. movement, 20,000 O.P.V., 44 A.C./D.C. ranges. Resistance Ranges up to 60 megs. Perfect order. **Special Price £10.**

SPECIAL OFFER of Constructor's parcel of 100 assorted resistors comprising, ¼, ½, 1 and 2 watt from 10 meg.-22 ohms. 12/6.

"AVO" MINORS, D.C. "E" type, also reconditioned and perfect order, £7/17/6.

ADVANCE SIGNAL GENERATORS. Type E.1. **£20.**

MEGGER SAFETY OHMMETERS. Perfect, **£3/10/-.**

H.R.O. SENIOR RECEIVERS. With A.C. P.P., 5 coils, **£28.**

D.S.T. 100 RECEIVERS, as new. Coverage is 7 bands from 30-Mc/s. to 50 Kc/s., **£20** each.

HALLICRAFTERS SX28, S27, S41, S38, etc. Perfect cond. **AR88LF, AR88D, CR100,** from stock. **R1155 RECEIVERS** and **"N"** models available, new.

CANADIAN R.103 RECEIVERS, as new, modified for A.C. working, **£18/10/-.**

LELAND R.F. WOBBULATOR, perfect order, **£12/12/-.**

A.C./D.C. MOTORS, suitable for sewing machines, 47/6 each.

A.C./D.C. 12 v.-15 v. MOTORS, long spindle for models, 15/- each.

NEW M/C MICROPHONES, hand type, with 12 yds. heavy duty screened cable, **£3/15/-** each.

TEST EQUIPMENT. We hold a comprehensive stock. Multi-range meters at 1,000 and 20,000 o.p.v., valve testers, signal gens.

10,000 OHMS POTENTIOMETERS, large size, by Colvern, enclosed 8/6 each. 100k, 15w., 9/6 each.

MAINS TRANSFORMER. 350-0-350 v. Ellison at 120 mA. 6.3 v. 5 a., C.T. 5 v. 3 a., **37/6.** Full range of all types of Ellison products in stock.

F.M. DEVIATION METER, in perfect working order, **£20.**

6 VOLT (3 at 2 v.) **BOXED ACCUMULATORS,** 14/-.

H.R.O. COILS. 46-96 Mc/s., etc., at **£2/5/-** per coil.

Your post enquiries welcomed. S.A.E. for reply, please. Orders, C.W.O. or Pro-forma Invoice, no C.O.D. Prices quoted do not include carriage and packing.

All types of equipment purchased. Top prices paid.

SERVICE RADIO SPARES
4, LISLE STREET, LONDON, W.C.2
Telephone: GERrard 1734.

Best Buy at Britain's

TEST SET TYPE 87. Ex- R.A.F. corresponds to TF796. Incorporates a signal generator covering 150 to 300 Mc/s. Also pulse generator. Operates from standard A.C. mains. Contained in handsome grey instrument case size 23in. x 10in. x 8½in. Basis of the audio signal generator described in "W.W." Aug. Sept. 1949. Complete with all valves and in brand new condition. Price £4/19/6.

U.H.F. SIGNAL GENERATORS by R.C.A. TYPE 710A. Covers 370 to 560 Mc/s. Large directly calibrated dial. Carrier level and 400 c/s. modulation monitored by large 200 micro-amp. meter. Precision piston attenuator. For A.C. mains operation 117 volts 50/60 c/s. Complete with instruction manual. BRAND NEW. £35.

3 CENTIMETRE TEST SET. Type 205A. In brand new condition. £17/10/-.

HOUR-METERS. Indicate the time any given A.C. mains operated apparatus has been in use. Ideal for life testing, process timing, etc. BRAND NEW and BOXED. 39/6 each.

E.M.I. OUTPUT METER. Desk type incorporating a 2½in. 1 mA. meter together with instrument rectifier, etc. 2 ranges 0-500 milliwatts and 0-5 watts and decibel scale. Brand new in original manufacturers' boxes wtih instructions. Price 35/-, post 1/6.

METER BARGAINS. ALL BRAND NEW

15 v. (50~) mov. iron 2½in. pnl. mtg....	8/6
20 volt moving coil 2in. sq. pnl. mtg. ...	7/6
3,500 volts moving coil 3½in. projection	10/-
150 milli-amp. 2in. sq. pnl. mtg.	7/6
20 amp. moving coil 2½in. dia.	7/6
1mA. 2½in. barrel flush pnl. mtg.	22/6
1 milli-amp. 2½in. barrel desk type	25/-
100 micro-amps. barrel pnl. mtg. scaled 0-1,500 in 15 clear divisions. Only	42/6
500 mA. Thermo Couple 2in. sq. pnl. mtg.	5/-

METER RECTIFIERS. 1 mA. Salford Instruments, 8/9. 5 mA. Salford Instruments, 6/9. 2mA., S.T.C. as used in E.M.I. Output Meter, 5/6. All are full wave bridge and brand new.

METAL RECTIFIERS. Heavy duty Selenium 10½in. long with 3½in. square plates. Two are required for a full wave bridge giving 48 volts at 10 amps. Brand new and ridiculously cheap at only 57/6 per pair plus 2/6 post. R.M.4 250 volts 250 mA. Only 12/6. R.M.2, 4/3 each or 2 for 8/-. Selenium 300 volts 100 mA. Brand new, ex-W.D., 6/9 each.

X'TALS

465 kc/s S.T.C. ½in. pins suitable for crystal, gates, IF checking, etc. Brand new, boxed 10/- each.
200 kc/s American G.E.C. ½in. pins suitable for crystal calibrators, etc. Brand new, boxed, 10/- each. 100 kc/s ½in. pin spacing. British, ex new units, 15/- each.

ROTARY POWER UNIT TYPE 104. Input 12 v., Output 230 volt 60 mA. and 6.3 v. at 2.5 amp. Fully filtered and smoothed and noise suppressed. Ideal for car radio, etc. Only 15/- each.

POWER UNIT TYPE 285. A.C. mains input 230 v. 50 cps. Outputs E.H.T. 2 kV. @ 5 mA., H.T. 450 volts @ 200 mA., L.T. 6.3 v. @ 17 amps., fully smoothed, 2 chokes, paper condensers, etc., complete with valves 5U4G, VU 120 and EF 50. This was the ground power unit for the "Gee" equipment and should be very useful for T.V., etc. A REAL BARGAIN AT ONLY £9/6.

RACKS. 6ft. "U" channel P.O. type for 19in. panels, heavy angle base. Price 79/6, plus carriage at cost.

MODULATOR TYPE 67. This unit is a pulse modulator with pulse width of 1, 2 and 5 micro-seconds. The pulse amplitude is also variable. It is a particularly useful instrument as it contains a heavy duty power pack suitable for 230 volt 50 cps. mains supply. The mains transformer outputs are 6.3 volts twice, 5 volts for the rectifier and the H.T. winding is 345-0-345 volts. Also included are 5 SP61, one VR116, 2 EB34, and 3 EA50. Size of case 18 x 9 x 7 inches. These units are brand new in original packing cases. Price 67/6 plus 7/6 carriage.

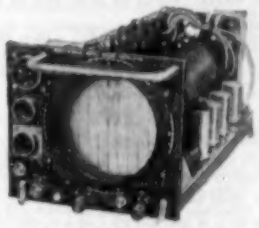
COMMUNICATIONS RECEIVER ADMIRALTY TYPE B.28 (MARCONI CR.100). Valve line up 2 RF, F.C. separate local Osc., 3 I.F.'s, 2nd Det., Output, B.F.O. an rectifier. Self contained power supply 200/250 volts A.C. 50 c/s. Variable Selectivity (crystal filter). 6,000, 3,000, 1,200, 300 and 100 cycles. Frequency coverage 60 kc/s to 30 Mc/s in six ranges, continuous except for gap between 420 to 500 kc/s. Size 16in. x 13½in. x 12in. Weight 82lb. The set for the serious operator. Thoroughly overhauled and in good condition, complete with new valves and air tested prior to despatch. A real bargain at only £27/10/- plus £1 carriage.

VALVE VOLTMETERS. Ex-R.A.F. Operates from standard A.C. mains. stabilised H.T. supply. Three ranges:—50/200/500 volts D.C. Meter employed 2½in. 1 mA. F.S.D. Contained in handsome wooden instrument case size 14in. x 8½in. x 9in. Complete with all valves and tested prior to despatch. In brand new condition and a real bargain at only 79/6 plus 5/6 carriage.

COMMUNICATIONS RECEIVER R.1155 World-wide reception is ensured by the R.F. and 2 I.F. stages. Five wavebands, 2 L.W., M.W. and 2 S.W. Magic-eye, large dial and vernier make tuning simple. Contained in attractive black crackle cabinet, its handsome appearance does justice to its superb performance. Supplied with FREE BOOKLET giving circuit data and details of the power pack required for A.C. mains operation. Fully aerial-tested before despatch. Gladly demonstrated to callers.
BRAND NEW. "MINT" condition, in ORIGINAL MAKER'S TRANSIT CASES, £11/19/6. Shop soiled models, as new, £9/19/6. A few only used models, £7/19/6, 10/6 carriage on each. Send S.A.E. for full details of power packs and receivers, or 1/3 for booklet.
'N' MODELS. Cover Trawler and shipping bands. Excellent condition, £17/19/6, plus 10/6 carriage. D.F. Loops and Visual indicator Meters available.
A.C. MAINS POWER PACKS AND OUTPUT STAGE. Enable the R.1155 to be used to operate speaker from 200/250 volts A.C. without ANY MODIFICATION WHATEVER. All our power packs have heavy duty transformers, are complete with leads and Jones plugs and are guaranteed for 6 months.
Type A. In smart black metal case, size 8½in. x 4½in. x 6½in., less speaker, price £4/10/- plus 3/6 carriage.
Type B. With built in 5 in. speaker in black metal case size 13½in. x 5½in. x 7½in. Price £5/5/- plus 3/6 carriage.
Type C. With an 8in. speaker in specially designed beautiful black crackle cabinet speaker to match receiver, size 11½in. x 10½in. x 6in. A de Luxe job. Price £6/10/- plus 3/6 carriage.
NOTE: 10/- REDUCTION WHEN PURCHASING ANY OF THE ABOVE POWER PACKS WITH RECEIVER.

TRANSFORMER BARGAINS. Brand new ex-manufacturer's surplus drop through. Primary 200/250 volts 50 cps. Secondary 310-0-310 v. 70 mA., 6.3 v. @ 3 a., 4 v. @ 2 a. Can be used with either 4 v. or 6.3 v. rectifier. Only 9/6 plus 1/6 post. A similar type transformer, 325-0-325 100 mA., 6.3v. 4 a., etc., can be supplied to callers only at 12/6.
Filament transformer, standard tapped primary. 12 v. 1½ a. and 6 v. 1½ a. secondary. Only 7/6.

HEAVY DUTY SLIDING RESISTORS. 250 watts rated to carry 25 amps., resistance 0.4 ohms, suitable for physics labs., charging board, etc. Laboratory type with worm drive, on metal stand, size 9in. x 4in. x 6in. high. Price 7/6 each. BRAND NEW.



INDICATOR TYPE 182A
Indicator contains 3 EF50, 1 SU4G, 4 SP61 and a 6½in. C.R.T. Type VCR 517, complete with Mu Metal-screen, 9 wire wound pots, with large assortment of resistors and condensers. Can be converted to Oscilloscope (as described in "Radio Constructor."). Circuit supplied. Tubes have no "Cut Off" and can be demonstrated to callers. BRAND NEW (less relays). In original transit case, 67/6 plus 7/6 carriage.

INDICATOR UNIT TYPE 9S. Exactly the same as the 62 indicator unit but is 50 cycle version. Double decker chassis, containing loads of components, 16 SP61, 2 EB34, 4 EA50, etc., etc. Brand new condition (less VCR97). Only 45/- plus 7/6 carriage.

45 Mc/s PYE STRIPS. Vision unit for London frequency. Complete with 6 EF50 and EA50. Circuit provided. Brand new. £3/10/- each.

E.H.T. TRANSFORMER. For VCR97, etc. Mains input, output 2,500 volts, 4 volts at 2 amps. and 2-0-2 volts at 2 amps. Fully guaranteed at 35/- plus 1/- post.

VALVE BARGAINS
New and in original boxes. 6AG5, VR53 (EF39), VR56 (EF36), 6K7G, 6C5Met, 6SH7-Met., VT501 (TT11), all at 6/6. RK34, E1148, 954, 2X2, VU120A, all at 2/6. Replacement bargain EL50, 5/-.
New, ex units, 6AK5, VR91 (EF50), Sylvania, VT52 (EL32), 807, 7/6. VR65 (SP61), 3/6. VT501 (TT11), 3/6. CV6, VR78. VR92 (EA50), 1/6 each, 15/- dozen.

U.S.A. BLOWER MOTOR for 105 volts A.C. operation. Outlet 2½in. diameter, extremely powerful. Snip for only 22/6 plus 2/- post.

CABLE. Heavy duty twin polythene weatherproof, suitable for extension mains, lead, etc. SPECIAL CLEARANCE OFFER, 39/6 per 100 yd. coil, plus 3/6 carriage. S.A.E. for sample.

NITROGOL CONDENSERS. With ceramic insulating terminals. 8 mfd. 2 kV. wkg. size 5in. x 3½in. x 4½in., at 12/6 each. 4 mf. 2 kV. wkg. size 3½in. x 2½in. x 4½in. at 7/6 each. 4 mf. 1.25 kV. wkg. size 3½in. x 2½in. x 4½in. at 5/6 each.
BLOCK CONDENSERS 40 mfd. 450 v. wkg. metal cased, paper insulation, size 4½ x 5½ x 4½in. Weight 5½lb. For power factor correction, etc. Brand New Price 15/- plus 2/- post. 8 mfd. 600 v. D.C. wkg. at 71° C. size 4 x 2 x 4½in. high. Very suitable for all good quality amplifiers, etc. Brand new Price 5/- each.

COMMAND RECEIVERS. BC455. Covers 6-9 Mc/s (33-50 Metres), 12SK7, 12K8, 12SK7, 12SK7, 12SR7, 12A6. Brand new. Black crackled, 69/6 plus 2/6 post.

BARGAINS, BARGAINS, BARGAINS, HUGE STOCKS OF COMPONENTS, RECEIVERS, VALVES, AT SPECIAL REDUCED PRICES FOR CALLERS.

CHARLES BRITAIN (Radio) Ltd.

11 UPPER SAINT MARTIN'S LANE
LONDON, W.C.2. *TEMple Bar 0545*
One Minute from Leicester Square Station (up Cranbourn Street)
Shop Hours: 9-6 p.m. (9-1 p.m. Thursday) *Open all day Saturday*

BENSON'S BETTER BARGAINS

BRAND NEW. ORIGINAL CARTONS. R.F. UNITS. TYPES 26 or 27, 27/6, 24 16/-. (Postage 2/6).

CONDENSERS, Variable min. spindled, 15, 25, 50, 75 pfs., 1/3. **DYNAMOTORS,** D.C. (approx. 250 v. 80 mA. at 6 v.), 8/6. Filters for these, 5/6. **I.F.Ts,** new, canned, 10/12 Mc/s., 1/6. **POWER UNIT** 250, 200 v. 50 c. input. Outputs D.C. 2 kV 5 mA. 350 v. 150 mA. A.C. 6.3 v. 15 a. 3 valves. New 75/-, carr paid inland. **TRANSFORMERS,** new, std. mains input; 500 v. H.W., 6.3 v. 3 a., 4 v. 7 a., 10/6; 250 v. to 6.3 v. 5 a. and 10 a. 17/6; 2 kV 5 mA. 2 v. 5 a. 22/6; 350-0-350 v. 150 mA. 6 v. 2 a. 25/-; 55 v. 30 mA. (twice) 6.3 v. 3 2 a., 9/-; 250 v. H.W., 30 mA., 6.3 v. 1.5 a., 8/6; 190 v. 8 mA., 6.3 v. 1.5 a., 8/6; 740-0-740 v. 165 mA. 470-0-470 v. 220 mA. 4 v. 8 a., C.T. (twice), 30/-; (carr. 5/-); 350-0-350 v. 126 mA. 6.3 v. 4 a. 4 v. 2 a., 16/- (postage 2/- each). R1115 Coilpacks, new, 12/6; used, 9/6; twin-knob S.M. drives, 7/6; I.F. Filters, 2/6. **METAL RECS.** H.W., 270 v. 60 mA., 6/-; 240 v. 30 mA., 4/-; 450 v. 50 mA., 6/6; 600 v. 30 mA., 9/-; 950 v. 150 mA., 9/-; 15 v. 1 a. C.T., 1/6. **RECORD PLAYERS,** brand new, xtal P.U. (famous maker), 33⅓/78 r.p.m., 79/6. **CRYSTALS,** 100 kc/s 9-pin, English, 15/-. **RELAYS,** Siemens H.S. 1 k+1 ½ coils, 10/6. **HEADPHONES,** new, 2 k., 11/6; **L.F. CHOKES,** 15 H. 200 mA., 9/6; 9 H. 150 mA., 7/6; 8 H. 80 mA., 4/6. **VALVE BARGAINS**—at 2/-: VR65A, VR66, 7193, VR54, 991, VR78, VR92, HK34, 954, CV54; at 4/-: EF50, 6AC5, 9001, VR116, KT24, 9C26 12SH7; at 5/-: 12SK7, ARP12, 6SH7, NG71, CV66, TT11, 6C6, 12SC7.

METERS—BRAND NEW—BOXED

PSD	Scale	Size	Type	Fit.	Price
25-0-25μA		2in.	MC	Pr.Rd.	35/-
100-0-100μA		2½in.	MC	Pr.Rd.	30/-
500μA	2v. AC	3½in.	MC	Fl.Rd.	22/6
1mA	Various	2½in.	MC	Pr.Rd.	17/6
1mA	0/10	2in.	MC	Pr.Rd.	15/6
2mA		2in.	MC	Pr.Rd.	12/6
5mA		2in.	MC	Fl.Sq.	7/-
5mA ¶	Lines	2in.	MC	Fl.Sq.	5/6
10mA		3½in.	MC	Fl.Rd.	7/-
25mA	50A	2½in.	MC	Fl.Rd.	7/-
30mA		2in.	MC	Pr.Rd.	6/-
40/120mA		2in.	MC	Fl.Sq.	5/6
100mA	800mA	2in.	MC	Fl.Sq.	5/6
100mA		3½in.	MC	Fl.Rd.	7/-
150mA		3½in.	MC	Fl.Rd.	7/-
150mA		2in.	TC	Fl.Sq.	7/-

List and enquiries, S.A.E. please! Terms: **CASH WITH ORDER.** Postage extra. Immediate despatch.

Callers and Post:	Callers only:
W. A. BENSON (WW), 308, Rathbone Road, Liverpool, 13. STO. 1606.	SUPERADIO (Whitechapel), LTD., 116 Whitechapel, Liverpool 1. ROY. 1156

20 CIRCUITS for 2/6 only

Enlarged again!

Our Supa-Handbook, "The Home Constructor" with its supplements (68 pages altogether) now incorporates :—

★ **20 CIRCUITS**—Superhets, T.R.F. Sets, Amplifiers, Feeder Units, Test Equipment, etc.
★ **SUPERHETS**—Full constructional details, supa-simplified layout and point-to-point wiring diagrams for building a variety of superhets.
★ **COIL PACK**—Full Constructional details for building a superhet coil pack.
★ **CAR RADIO**—Full constructional details.
★ **BATTERY CHARGER**—Complete details for building a CHEAP charger.
★ **RADIO GEN**—Pages of information, Resistance Colour Code, Formulae, and "know-how."
★ **RADIO CONTROL**—Supplement with theoretical and information.
★ **RADIOGRAM** Supplement.
★ **CATALOGUE**—Profusely illustrated price list of components.

YOU CAN'T GET BETTER VALUE! IT'S TOPS!

"The most helpful book in the Trade."

SEND 2/6 FOR YOUR COPY TODAY

SUPACOILS
(DEPT. W.2)
21, Markhouse Road, London, E.17

NEW G.E.C., S.T.C. AND "WESTALITE" SELENIUM RECTIFIERS. Largest L.T. range in Great Britain. Latest Current Products. NOT Surplus.

CURRENT PRICE LIST

DEDUCT 15% FROM S.T. & C. PRICES. S.T. & C. E.H.T. K3/15, 4/9; K3/45, 8/2; K3/50, 8/8; K3/100, 14/8; all post 4d. extra.

BRIDGE CONNECTED FULL WAVE. 17 v. 1.2 a., 16/4; 1.6 a., 24/-; 2.5 a., 29/-; 3 a., 36/-; 4 a., 34/6; 5 a., 37/6; all post 6d. 33 v. 0.7 a., 24/3; 1 a., 28/-; 1.5 a., 45/-; 2 a., 51/-; 3 a., 52/-; 4 a., 62/-; 5 a., 67/-; all post 1/-. 54 v., 1 a. 38/6; 1.5 a., 62/-; 2 a., 69/-; 3 a., 70/-; 5 a., 93/-; 72 v. 1 a., 49/-; 1.5 a., 78/-; 2 a., 81/-; 3 a., 92/-; 5 a., 122/-; 100 v. 1 a., 70/-; 1.5 a., 112/-; 2 a., 128/-; 5 a., 174/-; all post 1/4.

BRIDGE CONNECTED HEAVY DUTY 7⅛in. SQUARE COOLING FINS. 17 v. 6 a., 49/6; 10 a., 56/-; post 1/10.

BRIDGE CONNECTED HEAVY DUTY Funnel Cooled, also 7⅛in. SQUARE COOLING FINS. Revised price, same both types. 17 v. 12 a., 102/-; 20 a., 118/-; 30 a., 164/-; 50 a., £12/15/-; 33 v. 6 a., 91/-; 10 a., 104/-; 12 a., 148/-; 20 a., 188/-; 54 v. 6 a., 120/-; 10 a., 142/-; 72 v. 6 a., 154/-; 10 a., 178/-; 100 v. 6 a., £11; 10 a., £12/15/-; all post 2/-.

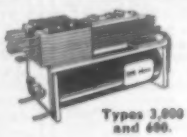
"WESTALITE" (BRIDGE), 12-15 v. D.C., 1.2 a., 15/10; 2.5 a., 27/6; 5 a., 31/9; 10 a., 54/6; 20 a., 99/6; 30 a., 144/10; 50 a., 257/-; 24 v. 1.2 a., 15/10; 2.5 a., 27/6; 5 a., 51/-; 10 a., 92/7; 20 a., 176/2; 36 v. 1.2 a., 27/6; 2.5 a., 51/-; 5 a., 69/10; 10 a., 130/9; **E.H.T. RECTS.,** 14D, 13⅓, 22/-; 36 E.H.T. 60 31/10, all post extra.

Wholesale and Retail
Special Price for Export and Quantity.

T. W. PEARCE

69 GREAT PERCY STREET, LONDON, W.C.1
(2 Pentonville Rd. Between King's Cross and Angel

MAGNETIC RELAYS



Types 3,000 and 600.

BUILT TO SPECIFICATION.

Coil Winding and Tropicalizing.

Spring Sets and Coils supplied separately if required.

Send for Price List or quotation.

KAYE ELECTRICAL MANUFACTURING CO.
Havelock Works, Havelock Place, Harrow, Middlesex.
HAR. 1432.

GOVERNMENT SURPLUS

FLASHER UNITS. Containing 2 600 slug type relays, each 8 platinum contacts. Will give approx. ½ second pulses from 12 to 24 volts supply. The whole mounted in metal die-cast box 4½ x 3½ x 3½in. high. Suitable for flashing indicator lights on cars, etc. Price 17/6, post 2/-.

POWER UNIT TYPE 46, for 230 v. A.C. supplies. Output 6.3 v. at 13 a. D.C., and 220 v. at 110 ma. D.C. Contained in a ventilated case 19 x 12 x 14½in. deep. Weight approximately 1 cwt. Price £5/10/-, Carriage 15/-. This is the power supply unit for 1155 Receiver LT and HT and 1154 LT.

VIBRATOR PACKS. 24 volt input, 110 volt D.C. about 40 ma output. Complete with 12 v. vibrator, stabiliser V5/110/A. Complete in metal case. New and boxed, 15/6 each, post 2/6.

AMPLIDYNE MOTOR GENERATORS. Ref. SAM3INJ18A. Input 27 volts at 44 amps, output 60 volts at 8.8 amps 530 watts. Brand new in maker's crate, 50/-, carriage 6/6.

ARTHUR T. SALLIS (W.W.)

93 North Road, Brighton, Sussex. Tel. Brighton 25806

Television · Radio · Record CABINETS MADE TO ORDER

ANY SIZE OR FINISH

CALL OR SEND DRAWINGS FOR QUOTATION

B. KOSKIE (DEPT. E.)

72-76 Leather Lane, Holborn, E.C.1

Phone: CHAncery 6791/2

LYONS RADIO Ltd.

POWER UNITS TYPE 285 Input: 230 v. 50 cps. A.C. mains. Outputs: E.H.T. 2,000 v. D.C. 5 mA., 350 v. D.C. 150 mA., 6.3 v. A.C. 5 A. and 6.3 v. A.C. 10 A. Soundly constructed units originally designed for operating "GEE" ground installations. Fitted with metal cased, paper condensers (not electrolytics), valves type 5U4, VU120 and VR91, etc. Housed in metal cases 16 x 12 x 9in. with input/output plugs, fuse holders and on/off switch mounted on front panel. In good condition and supplied with circuit diagram. **A REAL SNIP AT ONLY 69/6.**

SPECIAL VALVES. Type 807, as new, in original cartons, American made. **SPECIAL PRICE, ONLY 7/6** each. VU50S half wave directly heated rectifier. V. htr. 4 v. Max. A.C. V./plate 2,750 v. D.C. output I. 125 mA. Max. Pk. inverse 8,000 v. Pk. Plate I. 1A. **PRICE 10/-** CV173 (EF55), **12/6.** 866A, **12/6.** VR91's, dirty and marked externally but all tested and guaranteed electrically good. **PRICE ONLY** 3 for **10/6**; 6 for **19/6**; 12 for **35/-.**

PRECISION CONDENSER UNITS. These contain 5 metal cased condensers with the value of capacitance printed on each to 5 significant decimal places. These values to the nearest few places are .02, 14, .0012, .0019 and .023 mfd. The condensers are mounted on a metal chassis with cover, having an overall size of 19 x 4½ x 3½in., together with 3-tapped wire-wound resistors with clearly marked values and 3 other metal cased components which are probably inductances. **PRICE ONLY 7/6,** post 2/6.

3 GOLDHAWK ROAD (Dept. M.W.), SHEPHERD'S BUSH, LONDON, W.12 *Telephone:* Shepherd's Bush 1729

All UNIVERSAL ELECTRONICS equipment guaranteed in perfect condition

RECEIVERS

EDDYSTONE 640. 1.2-30 Mc/s. £22 10 0; 740. 550 kc/s.-30 Mc/s. £35; 750. £45; 670. £35. **HALLICRAFTERS** SX28 550 kc/s.-32 Mc/s. £45; SX24 £35; S20R £28; 1953 Portable model £50. SX71. AS NEW. **NATIONAL** HRO receiver complete with all coils, etc., from £28; **MARCONI** CR100 £30.
Set of three dials for AR88D per set £1 10.

MANUALS

For **RECEIVERS** AR88D-LF, AR77E, Marconi CR100, S20R SX24, SX28, B2 TX/RX, HROs, etc., photostatic copies ..... per copy £1 7 6

BRITISH TEST EQUIPMENT

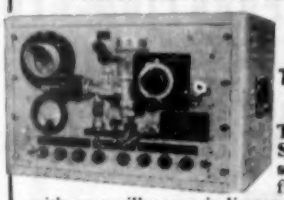
AVO Voltage Multipliers 1,200 v., 4,800 v., can be used with Model 40 Brand new. Carriage paid, each 5/6; Test Meter type 7 £15; AC/DC Minor £6; Roller panel valve tester. AS NEW £10; Valve Characteristic Meter. AS NEW £45. **TAYLOR** TV Wobbulator. 260A. AS NEW £28. **EVERSHED** Wee Meggers 500 v. £11 10 0; 500 v. Bridge types, etc. **MARCONI** Signal Generators, Type TF517, 150-300 Mc/s. £45; TF390G £45. **COSSOR** Double Beam scopes types 339A and 339 from £35.

SERVICE AND REALIGNMENT of all British and U.S.A. types COMMUNICATIONS RECEIVERS to makers' specifications AT LOW COST.

BENDIX BC221 Frequency Meters 125 kc/s.-20 Mc/s. available from stock.

Large range of VHF receivers and Microwave test equipment. Kindly write for details or requirements.

M.I.T. Radiation Laboratories



SPECTRUM ANALYSER TYPE TSX-4SE *(3 centimeter)*

The TSX-4SE Spectrum Analyser is an ultra-high frequency receiver with an oscilloscope indicator, in which the local oscillator is frequency-modulated by a sawtooth voltage proportional to the sawtooth sweep on the oscilloscope tube. It is used for observing the spectra of the pulsed oscillators, tuning receiver local oscillators, adjusting defective r.f. components, measuring large standing-wave ratios, and measuring the Q of resonant cavities.

ENQUIRIES AND INSPECTION INVITED

SPECIFICATION: Tuning range—8,630 Mc/s-9,550 Mc/s (723 AB klystron). Frequency calibration by means of a pip provided by a reaction type cavity wavemeter. I.F. frequency 20 M/cs. Receiver band width 50 kc/s. Receiver gain 130 db, 4 I.F. stages, 3 video stages. Sweep frequency variable from 10 to 20 cps. Attenuation graduated from 0-100 with calibration factor of 1.0 db/div. above 10.

EACH MONTH we will be illustrating and fully describing British and U.S.A. LABORATORY INSTRUMENTS which we have in stock. **Cut out and file the data for future reference.**

22 LISLE STREET, LEICESTER SQ., LONDON, W.C.2. *Shop hours, 9.30 a.m. to 6 p.m.* **OPEN ALL DAY SATURDAY** *Thursday 9.30 a.m. to 1 p.m.* *Write, Call or Telephone GERrard 4447 and MEAdway 3145* *8410 (Day) (Night)*

Prices slashed at Clydesdale

PLEASE NOTE. Carriage and Postal charges refer to the U.K. only. Overseas freight, etc., extra.

ELECTRONIC IGNITION TESTER. Type V.E.D. Patt. 563562 by English Electric in original wood case. A Carbode Ray tester for checking ignition of internal combustion engine while engine is operating, will operate from 6, 12, or 24 volts D.C. or 230 volts A.C. Built into black crackle case with hinged front and carrying handle. Dim.: 15¼in. x 8¼in. x 11¼in. No leads or instruction book available.
ASK FOR X/H535 **£15** each CARRIAGE 10/- EXTRA

INDICATOR UNIT TYPE 6H. With VCR-97 tube and valves, 4-VR91 (EF50), 3 VR51 (EF31). Dim.: 18in. x 8¼in. x 7¼in. Weight 27lb. In original wood case. ASK FOR X/E777 **59/6d.** each CARRIAGE 5/- EXTRA

INDICATOR UNIT TYPE 6. With VCR-97 tube and valves, 4-VR91 (EF50), VR54 (EB34), 3-VR92 (EA50), VR78 (D1), etc. Dim.: 18in. x 8¼in. x 7¼in. Weight 21 lb. In original wood case. ASK FOR X,H524 **45/-** each CARRIAGE 5/- EXTRA

R.F. UNIT TYPE 24. In original Carton. With valves 3-VR65 (SP61), etc. Range 20-30 Mc/s., switching tuning. Dim.: 9¼in. x 7¼in. x 4¼in. Weight 7 lb. ASK FOR X/H850 **10/-** each POST 1/6 EXTRA

R.F. UNIT TYPE 25. In Original Carton. 40-50 Mc/s, otherwise as R.F. 24. ASK FOR X/H347 **12/6d.** each POST 1/6 EXTRA

R.F. UNIT TYPE 27. With Broken Dial. Range 65-85 Mc/s. Valves 2-VR135 (EF54), VR137 (EC52), etc. Variable tuning. Dim.: and weight as R.F. 24. ASK FOR X/E771 **29/6d.** each POST 1/6 EXTRA

DISTRIBUTION BOARDS. 250 volts 15 amp, 3 way. A "Simplex" iron-clad 14 amp. distribution board with 6 rewirable fuses, highly efficient fuse unit, mounted on hinged battterns and fireproof fillet between poles. Size 8in. L. x 6¼in. B. x 3¼in. D. Weight 8 lb. Ask for X/H949. "Sandall e Duplex" similar but with no fillet. Overall size 8in. L., 8¼in. B., 4in. D. Weight 13 lb. Ask for X/H950.
"M.E.M. Kantark," similar, but with no fillet. Overall size: 8in. L., 7in., B., 3¼in. D. Weight 8 lb. Ask for X/H951.
All unused but slightly marked externally due to being stacked.
6/6d. each POST PAID
SPECIAL QUOTATION FOR QUANTITIES.

BRASS GLANDS. ¾in. diam. In three lengths, 1. 3/16, 1in., 1¼in. Bore ¼in. Price 1/3 each. Post Paid.

ROTARY CONVERTER TYPE 195. Input 24 V. D.C. 5 a. Output 230 V. A.C. 50 c/s. 100 w. Complete in metal case. Dim.: 13in. x 11in. x 8in. with carrying strap. ASK FOR X/H914 **£5.19.6d.** each CARRIAGE PAID

SUPPRESSOR UNIT SC/678. Contains 4 H.F. chokes and 4 tubular condensers 0.1 mfd. 250 V. D.C., carrying 5 amps. (2 sets on each lead) each choke and condenser separately screened in compartments of aluminium alloy box 4¼in. x 4in. x 2in. 4-hole fixing. ASK FOR X/H907 **2/6d.** each POST 1/- EXTRA

T1154B TRANSMITTER UNIT. Medium/High powered for C.W.-M.C.W. R/T 3 ranges 10.5 .5 Mc/s. 500 200 kc/s. Complete with 4 valves, etc., in metal case 14in. x 16¼in. x 8¼in. External power supply required. ASK FOR X/E5A **39/6d.** each CARRIAGE 7/6 EXTRA

VISUAL INDICATOR TYPE 1. Ref. 10Q/2. Dual reading left/right D.F. meter for R.1155 2¼in. Scale overall dim.: 3¼in. x 2¼in. In used condition. ASK FOR X/H862A. **12/6d.** each POST PAID

JEFFERSON TRAVIS UF-2 TRANSCEIVER CHASSIS. (U.S.A. made). Less valves and partly stripped by the M.O.S. ASK FOR X/H518 **17/6d.** each CARRIAGE PAID
Circuit at 2/3.

SUPPLY UNIT RECTIFIER FOR NO. 43 TRANSMITTER. Ex-Canadian Army in original wood case. Input 110 V. A.C. 50/60 c/s. 1,7 K.V.A. Output (H.T.1) 2,000 V. 375 mA. (HT2) 500 V. 400 mA. plus H.T. liner 450 V. 265 V. also 383 V. regulated and neg. bias 250 V. 150 V. 80 V. Making three complete power supplies all fed via double choke condenser, input circuits. Valves are 4/866A/866, 5Z3, 6517 2/6A3, VR150/30 (Stab.) and 1 V. (Time delay) The complete unit mounted in metal case with lid shock mounted. Dim.: 2ft. 6in. x 1ft. 6in. x 1ft. Finish olive drab. Weight 420 lb. AKS FOR X/H26 **£15** CARRIAGE 15/- EXTRA

RECEIVER UNIT TYPE 25. Ref. 10P/1L. Part of TR1196. Range 4.3-6.7 Mc/s. with valves 2-VR53 (EF39), 2/VR56 (EF36), VR55 (EBC33), VR57 (EK32), 2/I.F.T. .460 kc/s., etc., in metal case 6¼in. x 6¼in. x 6¼in. ASK FOR X/H299 **25/-** each POST AND PACKING 3/6

Order direct from:— *Phone: South 4451/7*

CLYDESDALE SUPPLY CO. LTD. 2, BRIDGE STREET, GLASGOW, C.5

FERGUSON
RADIO CORPORATION LTD

require

JUNIOR
and
SENIOR DEVELOPMENT ENGINEERS

for their well equipped and conditioned Laboratories at

SPENNYMOOR

The qualifications are initiative, sound technical experience in the field of electronics, including television, radio and test equipment. Permanent progressive posts offering exceptional promotion and prospects. Entrance to Pension and Life Assurance Fund.

Write stating age, experience etc., to :—

PERSONNEL MANAGER,
FERGUSON RADIO CORPORATION LTD
GT. CAMBRIDGE ROAD, ENFIELD, MIDDX

FOR EXPORT and to H.M. GOVT. CONTRACTORS ONLY

AVAILABLE FOR IMMEDIATE DELIVERY

RADAR

EARLY WARNING RADAR (mobile on trailers)—LORAN & GEE RADAR. METEOROLOGICAL MEASURING EQUIPMENT. NIGHT-FIGHTER RADAR — REBECCA EQUIPMENT.

RADIO TRANSMITTERS

R.C.A. ET-4336—(2-20 Mc/s. 350 watt).
HALLICRAFTER BC-610 (2-20 Mc/s. 350 watt). (New.)
WESTINGHOUSE GO-9 (300-18,100 Kc/s—CW and MCW only).
TECHRAD Model T-350XM (2-20 Mc/s. 350 watt). (New.)
R.C.A. 5 kW Transmitters. (New.)
Large quantities of spares for above.

COLLINS TCS EQUIPMENT

TEST EQUIPMENT

PULSE GENERATORS (Model 79-B—current production by Measurements Corporation).
MODEL 79-B generates pulses of continuously variable width and repetition rate (RR 60-100,000 pps., pulse width variable from 0.5-40 microsec.).
The instrument may be used for checking the response of video and r.f. amplifiers and investigation of peak measuring equipment. It will also simulate ignition and other types of interference for radio noise elimination research.
MICROWAVE FREQUENCY METERS (Model 105SM—Lavoie Laboratories). Frequency Range 375-725 Mc/s. Self-contained, battery operated, high precision instruments.
BC-221 Frequency Meters, TS-10A/APN, and a large range of TS instruments.

VALVES, MAGNETRONS & KLYSTRONS. (Surplus—guaranteed also Current production.) Large quantities always in stock

All our equipment is either new or rebuilt to original specification, including latest modifications.
All Airborne equipment can be released in our works to A.I.D. and/or A.R.B. Standard.

High Precision Electronic Development and Production Contracts undertaken.

BRITISH SAROZAL LTD.
1-3, Marylebone Passage, Margaret Street, W.1.
Telephone : LANgham 9351 (3 lines).
Cables: Sarozal, London. Telegrams : Sarozal, Wesdo, London

THE
BRITISH NATIONAL RADIO SCHOOL
ESTD. 1940

NOW IN OUR FIFTEENTH YEAR AND STILL

NO B.N.R.S. STUDENT HAS EVER FAILED

to pass his examination(s) after completing our appropriate study course.

FREE TRIAL LESSON, QUESTION and MODEL ANSWERS

— Radio, Telecoms., Maths.
and our ***NEW BASIC TELEVISION***

State subject and grade of any special interest.

A.M.Brit.I.R.E. and CITY and GUILDS Radio and Telecommunications Exams., etc., etc.

PRINCIPAL, M.I.E.E., M.Brit.I.R.E.
BRITISH NATIONAL RADIO SCHOOL
2, CANYNGE ROAD, CLIFTON, BRISTOL, 8
Tel. BRISTOL 34755

Wireless World Classified Advertisements

Rate 7/- for 2 lines or less and 3/6 for every additional line or part thereof, average line 6 words. Box Numbers 2 words plus 1/-. (Address replies: Box 0000 c/o "Wireless World" Dorset House, Stamford St., London, S.E.1.) Trade discount details available on application. Press Day: March 1955 issue, Thursday, January 27th. No responsibility accepted for errors.

WARNING

Readers are warned that Government surplus components and valves which may be offered for sale through our columns carry no manufacturers' guarantee: Many of these items will have been designed for special purposes making them unsuitable for civilian use, or may have deteriorated as a result of the conditions under which they have been stored. We cannot undertake to deal with any complaints regarding any such items purchased.

NEW RECEIVERS AND AMPLIFIERS

C.J.R. ELECTRICAL & ELECTRONIC DEVELOPMENT, Ltd., Bickford Rd., Witton, Birmingham, 6, Te., East 0822, SPECIALIZE in the manufacture of High Fidelity Sound Reproducing equipment, including:—
WILLIAMSON Amplifiers, Tone Control Stages with variable Steep Cut Filters, Cross-over Units, High Fidelity Portable Tape Recording equipments ideally suitable for replaying the new EMI pre-recorded tapes, Professional Recording Amplifiers, Microphone Mixing Units, etc. Send for details and leaflets. [0105

OUR new Mullard amplifier-MW/VHF receiver-transistor receiver, can all be heard at—Marlborough Yard, N.19, 6 mins. Archway Station, 25 mins. West End. Ring Arc. 5076. Bel Sound Products Co. [0184

SHIRLEY LABORATORIES, Ltd., 125, Tarring Rd., Worthing, Sussex, announce the superb "Jupiter" amplifier, type SB/1-15R, with pre-amplifier incorporated on same chassis; 15 watts output, response 15 c/s to 60,000 c/s extending to 150,000 c/s; bass lift 18 db, cut 18 db, treble lift 14 db, cut 20 db, hum and distortion almost immeasurable; 250v @ 20 ma, 6.3v @ 2 amps at octal socket; beautifully constructed to instrument standards, B.V.A. valves; price complete with engraved panel, £18/18. Also the "Mullard" 10-watt amplifier with tone-control system, £18/5; and the E.S.2 square-wave generating unit for converting your sine-waves to square-waves, £9.—Write for full details. Tels. 513, 5571. [3579

RECEIVERS, AMPLIFIERS—SURPLUS AND SECONDHAND

NEW ZEALAND TX-RX No. ZC.1 inter-communication sets for mobile work, built in Vibrator Packs for 12 volt operation. TWO types available:—
MK. I: 13 Valve TX-RX 2.2 to 6.5 MCS in one band. Power output approx 2 watts. CW or phone. Break in operation, built in aerial tuner for all types of aerial. Size 22×10×12. Weight approx. 50lb. Waterproof cover.
MK. II As above except covers 2 wavebands 1.85-4 Mcs and 4-8 Mcs and 11 valves with synchronous vibrator.
THESE sets are absolutely brand new, they have never been in service. The outer cases are slightly soiled due to storage, but the sets have been hermetically sealed.
Each set is supplied complete with instructions manual, 1 pair moving headphones, 1 moving coil, hand microphone, key, set of heavy battery leads, and set of resilient mountings.
PRICES: Mk I £9/19/6 + 15/- carriage.
Mk II £12/19/6 + 15/- carriage.
EXTRA moving coil 'phones, 15/- set.
WALTONS Wireless Stores, 48, Stafford St. Wolverhampton (Tel. 22059) Staffs. [0147

HRO Rx's and coils in stock, also AR88, BC348R, CR100, etc.—Requirements please to R. T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986 [0055

R.F. units types 26 at 27/6, 25 at 15/-, 24 at 11/-, brand new in original cartons, with valves; postage 2/6.—E.W.S. Co., 69, Church Rd., Moseley, Birmingham. [3595

AMPLIFIER, 2 speakers, turntable mike, etc., new condition, 40 watts; proceeds of sale for Group Captain Cheshire, V.C.—Write to Warden Le Court, Liss Hants. [3962

WIRELESS WORLD 2 R.F. 3-valve quality tuner, M.W. and L.W., unused, ideal for use with all high fidelity amplifiers; £6/10, including valves, limited number; bargain.—Box 0000. [4035

TV RECEIVERS, AMPLIFIERS—WANTED NEW LOUDSPEAKERS

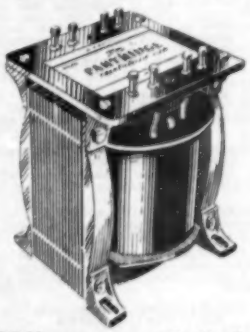
GOODMANS loudspeakers, also supplied in polished cabinets, write for list, easy payments.—Stamford (Dept. D.21), 20, College Parade, Salusbury Rd., London, N.W.6. [3997

If you are building your own amplifier . . .

or any other audio equipment calling for high quality transformers you should complete and post the coupon below immediately. This will ensure that you receive the following:—

1. **An article on High Fidelity and the output transformer by J. C. G. Gilbert, F.R.S.A., Assoc.I.E.E., M.Brit.I.R.E., etc. (reprinted from "Music Trades Review").**
2. **An illustrated brochure giving full details of the Partridge components specified for the Ozram 912 and Mullard 510 amplifiers.**
3. **Technical data sheets and all available literature on the Partridge range of transformers and chokes.**

This material is free. Post the coupon now.



PARTRIDGE TYPE P3591A **£4.5.0**

(Push-pull output) Specified in the Ozram 912 circuit. If performance down to 30 c/s is required it is essential to employ a transformer of this calibre.

OVER 100 STANDARD TYPES

are available in the Partridge Range. Our Catalogue gives full technical details frequency response curves, etc.

Post this coupon now!

To PARTRIDGE TRANSFORMERS Ltd.
Roebuck Road, Tolworth, Surrey.

Send me:
(1) The article on High Fidelity.
(2) Illustrated brochure for amplifier components.
(3) Technical data sheets.
(Cross out which not required.)

or

NAME .....

ADDRESS .....

.....

Please use Block letters. W.W.255

LOUDSPEAKERS—SURPLUS AND SECONDHAND

HARTLEY TURNER 215 speaker, condition as new; offers.—Emmott, The Porch, Portsmouth Rd., Esher, Surrey. [4008

GOODMAN'S Axiom 150 Mk. 2 speaker in 11-ply corner cabinet, Goodman's specification as new; £12.—Whittle, 99, Market St., Hindley, Lancs [4068

TEST EQUIPMENT—SURPLUS AND SECONDHAND

SIGNAL generators, oscilloscopes, output meters, valve voltmeters, frequency meters, multi-range meters in stock; your enquiries are invited.—Requirements to R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986 [0056

UNIVERSAL meter Taylor model 90A RS 66 first-grade accuracy, 1000 o.p.v. AC/DC, £8/10 only; also valve tester 45A/8 with adaptors measuring mutual conductance of almost all modern valves, £14; both in perfect condition, practically new.—Write: Strauss, 5, Gloucester Ave., Slough, Bucks. [3897

FREQUENCY stabilising sets by G.E.C., comprising one multivibrator unit 100kc/s to 1kc/s, one ditto 1k/s to 50c/s, and one 3-phase amplifier unit for 50c/s stabilised output; all three units fitted power pack for 200-250v single phase a.c. mains, mounted in standard rack 56in high complete with 100kc/s crystal, 27 valves and circuit diagrams, new; £39.
BRIDGE-MEG testing sets by Evershed & Vignoles, 250v self-contained type in alloy case, rang: 0.01Ω to 50MΩ, leather case, used, accuracy tested, £13/15; ditto, 1,000v, 0.01Ω to 200MΩ, as new £35.
MICROAMMETERS 2½in M.C. flush, round, centre zero, Sangamo-Weston, 250-0-250 microamps, new, 22/6 p.f.
CAMBRIDGE Unipivot meter, 100 microamps f.s.d., 5in mirror scale calibrated 0-120, in hardwood case 9in×9in×5in, with Cambridge Vacuo-junction 0-5ma, 20mc/s max., as new; £6/15, carr. paid.
FREQUENCY meters, all 40-60c/s, 4½in dia., flush, 130v, £5; 4½in dia., semi proj., 130v, £4; 6in dia., proj., 230v, £8; 7in dia., proj., 210-455v, £9; all p.f.
ELECTRICAL tachometers, calibrated 40-60c/s, 4½in dia., flush, 12/18v a.c., rect./M.C., complete with separate a.c. tacho-generator, reads 50c/s at T-G speed, 5,000rpm, new; 37/6 p.f.
TONGUE-TEST ammeters, Crompton-Parkinson 2-range, 0-100 and 0-400amps, leather case; 97/6 p.f.
VARIAC transformers, all 230v input, type 200CUH, 0-270v, 2 amps, £6; type 100L, 0-230v, 8amps, £14; type 50B, 0-270v, 20-31amps, £35.
CONSTANT voltage transformers, input 185-260v, output 230v, 630VA, 1-ph., £12; carr extra except where stated.—P. B. Crawshay, 94, Pixmore Way, Letchworth, Herts. Tel. 1851. [5945

NEW DYNAMOS, MOTORS, ETC.

WARD rotary converters for radio, television amplifiers, etc.
ALSO, rotary transformers, alternators, DC generators etc.
SPECIAL offer.—Revolving armature alternators, 2 pole, ball bearing, 5,000 r.p.m., with direct coupled 24-30v exciter and voltage control components; output 230v, 50 cycles, 3.25 k.v.a., 8 power factor; price with Vee type pulley, £42 each, nett, ex-works.
WARD, 75, South St., Bishops Stortford, Herts. Tel. 1004 [0039

SPECIAL television rotary converters, guaranteed interference free, fitted radio and television filters, wt. 60lb, d.c. input 12v 200va, out. 24v 32v, 50v, 110v, 230v d.c., to 230v out. 250va, £25/10 del., also converters for radiogram and general use, inputs, outputs and prices as above; the above also supplied without smoothing, £25 del. Immediate despatch; trade supplied.
AT a purchaser's home 60 mls. S.W. of Sutton Coldfield a 24v
TELEVISION converter was tested on Ekco television, 12in tube, stated consumption 135 watts d.c. current from battery only 9½ amps, picture and sound were perfect and completely free of interference or flutter.
THE above is the latest product of British manufacture and is guaranteed for one year.
J.A.P. No. 2A 1.2hp petrol engine, air-cooled, 4-stroke, starting rope, tools; £17/10 delivered.
T. W. PEARCE, 66, Great Percy St., W.C.1 (near Angel). [0015

FOR SALE AND WANTED ADVERTISEMENT FORM TURN TO PAGE NO. 165

THE MODERN BOOK CO.

BRITAIN'S LARGEST STOCKISTS OF BRITISH and AMERICAN TECHNICAL BOOKS

Radio and Television Engineers' Reference Book edited by E. Molloy. 75s. 6d. Postage 1s.
Basic Television by B. Grob: NEW EDITION. 48s. 0d. Postage 1s.
Practical TV Aerial Manual for Bands I and III by R. Laidlow. 4s. 6d. Postage 3d.
Principles of Transistor Circuits edited by R. F. Shea. 88s. 0d. Postage 1s.
Telecommunications by A. T. Starr. 35s. 0d. Postage 9d.
Electronic Organs by R. L. Eby. 49s. 6d. Postage 9d.
Principles and Practice of Radar by H. E. Penrose and R. S. H. Boulding. 30s. 0d. Postage 1s.
Magnetic-Amplifier Circuits by W. A. Geyger. 42s. 6d. Postage 9d.
Television Engineers' Pocket Book edited by E. Molloy & J. P. Hawker. 10s. 6d. Postage 6d.
Television Receiver Servicing: Vol. I—Time-Base Circuits by E. A. W. Spreadbury. 21s. 0d. Postage 9d.
The Oscilloscope at Work by A. Haas & R. W. Hallows. 15s. 0d. Postage 9d.
Brimar Radio Valve and Teletube Manual: No. 5. 5s. 0d. Postage 4d.
Radio Valve Data compiled by "Wireless World." 3s. 6d. Postage 3d.

Please write or call for our catalogue.

19-23 PRAED STREET
(Dept. W.2)
LONDON, W.2
'Phone: PADdington 4185
Open all day Saturday

SURPLUS

AERIAL MASTS. American Yagi 5 element array AS-46/APG. 30ft. one piece 4in. dia. hollow wood masts. 36ft. 3 section 2in. dia. tubular steel masts. 45ft. 9 section 1¼in. dia. American steel masts MS-44. 50ft. Bendix plywood masts MT-7A. 70ft. American plywood masts. 200 m/cs "H" dipoles. 20ft. American tripod base aluminium masts AS/TPX. 9ft. one piece American police whips. 18ft. BC-610 6 section whips.
TELEPHONE AND TELEGRAPH APPARATUS. 1 + 1 terminals and by-pass filters; 1 + 3 terminals; 1 + 4 terminals and repeaters, S and SX, S and DX, filter; power bays; repeaters; V.F. ringers; perforators; Wheatstone equipment; teleprinters; undulators; switchboards; rectifiers EE-65, TG-10, etc., etc.
AUDIO EQUIPMENT. R.C.A. squadron announcers (12-25 watt speakers). R.C.A. 25 watt high power speakers. Portable megaphones PA-4. **SCR 625 MINE DETECTORS.**
CONTROL UNITS. BM-6, 7, 12, 13, 21, 25, 29, 42.
AMERICAN TRANSMITTING TRANSFORMERS AND CHOKES. A large variety by Amertran, Kenyon, R.C.A., Thordason, etc., etc.
TRIPLE DIVERSITY RECEIVERS. 1.5 to 30 m/cs. Self contained on rack with all refinements. Full details available.
100 WATT BROADCASTING TRANSMITTERS by Woden. Self contained in 4ft. 6in. cabinet £22/10/- with valves.
RACKS, de luxe, 19 inches wide channel iron sides, 3 in x 2, 3in. 6in. high, 40/-; both carr. 10/-.
Many other items too numerous to mention. Send your requirements. Lists available. All packing and shipping facilities.

P. HARRIS
ORGANFORD DORSET
Telephone: Lytchett Minster 312.

DYNAMOS, MOTORS, ETC.—SURPLUS AND SECONDHAND

2,000c/s motor-alternator sets, input 220v d.c., output 80v, 1ph, 2,000c/s, 6.25amps, 500VA, complete with starter, fuses, control panel and voltmeter, all mounted in ventilated steel cabinet 16in x 26in x 49in high, new in original cases; £16, carr. extra.—P. B. CRAWSHAY, 94, Pixmore Way, Letchworth, Herts. Tel. 1851. [5945

NEW GRAMOPHONE AND SOUND EQUIPMENT

FERROGRAPH magnetic tape recorder 76gns.
WEARITE tape decks and component parts.
DISC recording machines and blank discs.
LEAK amplifiers, 10w £17/17, preamp £10/10.
GOODSELL, 5w £15/10, preamp £10/10.
RESLO ribbon microphones and stands.
EVERYTHING for the professional recording studio and quality dealers.
SOUND DISCS (SUPPLIES), Ltd., 178, Bispham Rd. Southport, Lancs. Tel. 3155. [3169

T./R. amplifiers for Truvox, Lane Decks, etc.; 5 watt £14, 10 watt 19gns.
F.M. tuners, Denco £8, ready built.
U./L. 14 watt amps, with pre-amp, £24.
HARDING ELECTRONICS, 120a, Mora Rd., London, N.W.2. [0052

FERROGRAPH tape recorders for high grade sound; H.M.V. 2300 Disc Recorder, complete (1 only); Emidiscs and Emitape 68; microphones, speakers, etc.
"ESOTERIC" RECORDING SERVICES. (See "Miscellaneous," page 153.) [0122

TAPE recorders for sale, exchange, or hire in Greater London, good quality tape recorders wanted for cash, all types of repairs, mechanical and electronic, carried out by specialists, all accessories available, we deal exclusively in magnetic recording equipment.—THE MAGNEGRAPH RECORDING Co., Ltd., 1, Hanway Place, London, W.1. Tel. Langham 2156. [3596

CINE-VOX disc recording equipments, type C/J for high-quality recordings from existing microphone equipment; price from 28gns; also available as a complete channel inclusive of mic., amplifier and playback equipment, at 70gns; type C/T, for highest quality professional requirements—recorder mechanism at 46gns, or complete channel at 110gns; demonstrations arranged in London.
PLEASE write for details to K.T.S., Ltd., "Coplow," Park Rd., Braunton, N. Devon. Tel. Braunton 224. Callers by appointment only. [0209

GRAMOPHONE AND SOUND EQUIPMENT —SURPLUS AND SECONDHAND

C.J.R. tape recorder monitor and mixing facilities, studio quality; £70.—Box 0947. [4054

GARRARD RC75/AC automatic record changer, high fidelity heads mounted, as new; £12.—Emberbrook 4278. [3970

MSS type PM/1 tape recorder, little used, ribbon mic., 5 rolls tape; can be seen Central London; offers around £55; cost £135. —Box 0718. [3964

GRAMOPHONE AND SOUND EQUIPMENT—WANTED

WANTED.—Garrard R.C.90 record changer, mechanism only.—Offers to Lovegrove, Neal's Farm, Wyfold, Checkendon, Oxon. [4052

NEW COMPONENTS

TRANSFORMERS?
WHY not ask us to give you a quote?
WE manufacture high-quality transformers to suit your requirements at very competitive prices; our delivery is good, and all our work carries a 12 months' guarantee.
WOODROW TRANSFORMERS, Ltd., 7, Dudden Hill Lane, Willesden, N.W.10. Tel. WIL 1347. [3946

COMPONENTS—SURPLUS AND SECONDHAND

GERMANIUM diodes, 1/- each; quantities cheaper.—S.D.C., 391, Green Lanes, London N.8. [3649

SOUTHERN RADIO SUPPLY, Ltd., 11, Little Newport Street, London, W.C.2. See our displayed advertisement, page 161 [0016

WESTINGHOUSE "Stabilistor," constant voltage stabiliser, input 190/260, output 250 volts, 600va, believed unused, £10/10; rectifier units 230, input 110 volts D.C. out 2.5 amps £6/10.—Hutchings, 1, Kinloch St., N.7. [4051

50,000 m/c.s.-g.ass seals, single way hermetically sealed terminals for soldered connections and fixing, mostly 18v and 28v sizes, new; 65/- per 1,000 assorted.—P. B. Crawshay, 94, Pixmore Way, Letchworth, Herts. Tel. 1851. [5944

VALVES new and guaranteed surplus, all boxed. CV131, 5/6; CV133, 7/6; CV136, 6/6; CV138, 6/6; CV140, 6/-; CV216, 8/6; CV545, 10/-; CV416, 9/6; CV417, 7/-; CV449, 10/6; CV452, 7/-; CV455, 7/-; CV491, 9/-; CV492, 7/-; CV493, 11/6; CV686, 9/-; CV753, 6/6; CV797, 8/6; CV850, 7/6; CV858, 7/6; CV1758, 6/-; CV2127, 6/6; CV2129, 9/-; CV2179, 10/6; CV2209, 9/6; post 6d each. 500 other types stocked; s.a.e. for full list. 24-hour service, cash with order or C.O.D.—Bentley, Ltd., Radio House, Chalcot Rd., London, N.W.1. Primrose 9090. [3905

Excellence in design...
Specialists in Sub-miniature Telecommunication Components

AIR DIELECTRIC TRIMMERS 70pF

Illustration (approx.) actual size

Type approved Cat.A No. 464

12 Vane type 500 Volts
Width 16.5mm Length 22mm
Height 19mm Insulation 10,000 megs.
Power Factor less than .001
Temp. Coeff. 50 parts/million/°C

OXLEY
DEVELOPMENTS CO. LTD.
ULVERSTON, NORTH LANCS
Tel: ULVERSTON 3396

CABINETS

We can supply any Cabinet to *YOUR OWN SPECIFICATION*. The one illustrated can be obtained in Walnut, Oak or Mahogany for £19/15/0 or as a COMPLETE RADIOGRAM incorporating:

5 Valve Superhet Autochanger and 10in. Speaker for...	£48/17/4
8 Valve Armstrong F.C.48 Autochanger and 10in. Speaker for...	£62/14/4
10 Valve Armstrong R.F.41 Autochanger and 10in. Speaker for...	£70/16/0
14 Valve Armstrong 125/C Autochanger and 10in. Speaker for...	£88/6/4

(H.P. terms can be arranged)

Send 1/- for complete Catalogue of Cabinets, Chassis, Autochangers and Speakers (refunded on receipt of order).

LEWIS RADIO CO.
120, GREEN LANES, PALMERS GREEN, LONDON, N.13. BOWes Park 6064

DUODE 12c

SUPREMELY NATURAL SOUND

INSIST ON HEARING A DUODE

Whatever your amplifier
Whatever your cabinet
Whatever your pickup
Whatever your receiver
Whatever your radiogram
It *must* end in a Duode

The greatest care taken in choosing any or all of these primary stages of a good quality installation is wasted unless the same care is given to the choice of the most important most critical final stage of all—the recreator of sound itself.
That choice has to be lived with for some time. A hasty decision and failure to hear a Duode may condemn the really critical ear to a long sentence. So, before you plunge

INSIST ON HEARING A DUODE

The Duode 12c is a 12in. unit with the famous dual drive, built-in crossover and feedback, giving a range from below 25 to over 16,000 c.p.s., PLUS absolute smoothness and a grip of transients and bass which is unequalled. Definition throughout the range is superb. NATURALNESS, freedom from boom or harshness and continuing pleasure are the fruits of DUODE ownership. The 12c at £20 is the finest high-quality sound unit available today. The 12b at £14 and 12a at £10 are also the best in their categories.

Any recognised music or radio dealer can, if he wishes, buy Duode Units from us for his stock and demonstration. If yours will not do this for you, we will help by offering you the facility of trying a Duode at home under very fair and reasonable conditions.

Write for details today

Barker Sound Reproducers
3 Newman Yd., London, W.1

COMPONENTS—SURPLUS AND SECONDHAND

SUPREME RADIO, 746B, Romford Rd., Manor Park, London, E.12.
TEL. Ilf. 1260. Est. 19 years.
1955 RADIO and television component part bargains at the right price.
ELECTROLYTIC cond., 8mfd 450v working, sleeved tubular w/end our price; 1/11 ea.; 32mfd 350v tag end, aluminium can, small, 1/6 ea.; 16+8mfd 450v all can or sleeved w/end, 4/9 ea.
4MFD 150v Dubilier Drylytic w/e card. cond., 10d ea.
25MFD 25v Micropack tag end metal blaz cond., 1/4 ea.
METALPACK 0.1mfd 350v condensers, 8d ea. or 7/6 doz.
SPRAGUE 0.1mfd 350v w/end cond., 6d ea. or 5/6 doz.
INT/OCTAL v/holders, Amphinol type, 6d ea. or 5/6 doz.
E.F.50 valves, Red Sylvania, 10/6 ea.
ALL parts in stock for "Denco" F.M. unit; this will be the future rad.o.
DENCO F.M. Technical Bulletin "DTB8" for building F.M. tuner unit, 1/6.
CO-AXIAL cable, 80ohm, brown or black, 8/- doz. yds.
STEEL chassis, ready punched for s/het layout, 14.n×6.n×3.n, 2/6 ea.
HEATER trans., 0 250v sec 6.3v at 1.5amp, large.n pr.ce, 5/9 ea.
TAPPED heater trans., 0-210v-250v-250v, sec., 0 2v, 4v-6.3v at 1.5amp, really a bargain at 6/6 ea.
SMALL type vol/controls, 1meg or ½meg with i/spindle and S/P switch, 2/6 ea.
POPULAR mains trans, buy shrouded upright mounting with base connections, 250-0-250v, 60m/a, 6.3v 1.5amp and 4v 2amp, with screen, primary tapped on vol/panel, 0-200v, 220v, 240v size, H.3¼in w 3¼in, D2¼in, our price, 12/6 and 1/- pack/post.
HUNDREDS of other bargain lines in stock and our price is right. Your enquiries welcomed.
TERMS: C.w.o. no c.o.d
SEND 9d extra for postage orders under £5. 2½D s.a.e. all enquiries and list. (0021

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188.
ELECTROLYTICS, capacity, voltage, size, type of mounting, price post paid: 400, 6v, 1×2in, lug, 1/9; 250+250, 6v, 1×2in, lug, 2/-; 40, 150v, 1×2, clip, 2/6; 20+20, 275v, 1×2, lug, 3/3; 16+32, 275v, 1/2, lug, 3/3, 16+16, 275v, 1×2, clip, 3/3; 100, 275, 350v, 1¼×3, clip, 3/6; 32+12, 350v, 1⅝×2 clip, 4/-; 16+16, 350v, 1¼x2, clip, 1⅝×2, 4/9, 16, 350v, ⅞×2, lug, 1/9; 40+40, 300v, 1×3, lug, 3/6; 10, 450v, ¾×2, lug, 1/6; 16, 450v, ⅞×2, tag, 2/9; 20, 450v, 1×2, 2/3; 32, 450/525v, 1⅝×2, clip, 3/9; 15+15, 450v+32mf 25v, 1⅛x3, lug, 4/6; 200, 6v, ⅝×1⅝, clip, 1/6; 100, 12v, ⅝×1⅝, clip, 1/9; 8, 450v, 1×2, clip, 2/-; 50, 12v, ¾×1⅝, tag, 1/6, 150, 25v, ¾×1⅝, clip, 2/-, 250, 12v, ¾×1⅝, wire 2/3; 1c+16, 450v, 1⅝×2, clip, 4/-; 40+40, 275v, 1⅝×2, clip, 3/3, 24+24+16, 350/425v, 1⅝×2, clip, 4/9; 60+200, 275/350v, 1⅝×4½, clip, 6/6; 4, 150v, ⅝×1¼, clip, 1/1; 500, 12v, 1⅝×2¾, clip 2/-; 8, 350v, ¾×2, clip, 1/9, 32+32, 350/425v, 1⅝×2, clip, 5/-; 8+16, 450×525v, 1×2, clip, 4/-; 2, 450/525v, ¾×1⅝, tag, 1/6; 8+8, 450v, ¾×2, clip, 1/9; 32+32, 450/525v, 1⅛in×3in, wire ended, 5/6; 64+120, 275v, 1¾×4½, clip, 5/6; 1,000+1,000, 6v, 1×3in, lug, 3/3; all all cans, some with sleeves, all voltages, WKG, surge where marked, new stock guaranteed.
TELEVISION! Set of 4 components, comprising line output trans. with E.H.T. winding to give 7kV, using EY51 (heater winding for EY51 also included), and fitted with width control scanning coils, low impedance line and frame, focus coil (res. 10,000Ω), current approx. 20 mA; the set of 3 for 42/-, plus 2/- post, diagram of line trans. supplied.
UNIVERSAL amplifiers, 8-valve 20watt A.C./D.C., black crackle chassis, and black and chrome cover, overall size 15¼in×7½in×7in. First-class components (Partridge O.P.T., and driver, Gardiner choke, A.F.E. Mu-Metal input trans. for mike). Valves, 2×EF37, 4×CL33, 2×URSC. Switched input for high or low imp., top cut and bass cut switches, V.C., mains switch, mains plug and socket, 220-250v, isolated chassis, 15Ω output, wired and tested, ready for use, with valves, brand new, £10/19/6, carr. paid
5mA meters, moving coil, bakelite case, 2in square, flush mounting, new, boxed; 7/- post paid.
MAINS trans., 250-0-250v, 80ma 6.3v, 2.5A, 6.3v, 0.6A, 5kV, 0-210-230-250v 12/- post paid.
RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188 (0015

WANTED, EXCHANGE, ETC.

VHF test equipment.
TS47AP, TS174, TS175/U, TS148 or TSX-48E, analysers; BC221 freq meters, TS69, and any U.S.A. test gear; Klystrons type 723/AB, 2K28, 2K39, 2K41; receiver, APR4 and units TN16, 17-18-19; RCA AR88D, 827 and 8X28s and 827CA; microwave equipment; highest offers given by return.—Ger, 5410, Universal Electronics, 27, Lisle St., Leicester Square, London, W.C.2. (0229

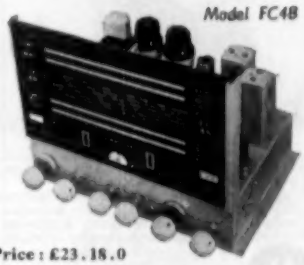
WANTED, receivers A.P.R.4, also T.N.16, 17, 18, 19, etc., and any radio test gear.—LESLIE DIXON & Co., 214, Queenstown Rd., Battersea, S.W.8. Macaulay 2150. (0176

WANTED, HRO coils, Rxs, etc., A.R.88s, BB54as, 827s, etc.—Details to R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4966. (0165

Armstrong

Specialists in the manufacture of the

HIGHEST QUALITY CHASSIS



Price: £23.18.0

FC 48 RADIOGRAM CHASSIS

with provision for F.M. Tuner.

- 8 Valves including 2 double triodes.
- 8 Watts output from Push-pull Tetrodes.
- Independent Bass and Treble lift and cut.
- Magic Eye tuning indicator.
- Coverage 16-50, 49-120, 190-550, 900-2000 metres.
- Large four colour illuminated dial.
- Overall size: 121" x 9" x 9½" high.
- Supply: 200-250 volts A.C. mains.

TWIN Radiogram Price 57 Gns. (Inc. Tax).

RADIOGRAMS We now have a fine range of High Fidelity Radiograms which are much in demand. The Twin model incorporates the magnificent FC.48 chassis, the new latest 3-speed intermixing record changer, and high flux 10in. loudspeaker. The cabinet is finished with a beautiful walnut veneer.

TELEVISION The TV.5 Range is available in many forms and incorporates all the most up-to-date improvements such as 5-channel selector switching and aluminised flat faced tube and tinted filter.

★ PROVISION IS MADE FOR AN ADAPTOR WHICH WILL ENABLE YOU TO RECEIVE ALL 13 CHANNELS, WHICH WILL BE AVAILABLE AT A NOMINAL CHARGE WHEN REQUIRED

The TV.5 Range really give the TRUE BLACK AND WHITE PICTURE.

TV.5 14in. Chassis, **£54/0/3 (Inc. P.T.).**
TV.5 14in. Console, **£72/9/0 (Inc. P.T.).**
TV.5 17in. Chassis, **£64/15/11 (Inc. P.T.).**
TV.5 17in. Console, **£82/19/- (Inc. P.T.).**

Our Showroom at the address shown below is open daily from 9 a.m. to 6 p.m. (Saturdays 5 p.m.) and we are always delighted to demonstrate any of our Models or supply any information regarding them. If unable to visit us please send for the specifications you may require to Dept. WF.

ARMSTRONG WIRELESS & TELEVISION CO. LTD.
WARLTERS ROAD, HOLLOWAY, LONDON, N.7
Telephone: NORth 3213/4

This UNIQUE BENDER

Quickly and Accurately Forms
Angles, Channels, Sections, Boxes, Lids, Trays, Tanks, Chassis Brackets, Clamps, Clips, Shrouds.
Chemical, Electronic and Electro Medical apparatus. Used by leading Radio Manufacturers. Invaluable to Servicing Engineers, Hospitals, Universities and Research Workers.
For 6 page folder write to :—
A. A. TOOLS (W)
197a Whitegate Rd., Ashton-u-Lyne
Every genuine A.A. tool bears this mark.

'Radiospares' Quality Parts
THE SERVICE ENGINEER'S FIRST CHOICE

WEST END RADIO
AUTO-TRANSFORMERS
BRYAN SAVAGE, HEAVY DUTY
INPUTS:— 110-130-200 & 250v. Switch controlled. OUTPUTS:—110 & 250v. at 3 K.V.A. normal. 1-2 K.V.A. TROPICAL. DIMS 8" x 8" x 13". Totally enclosed in heavy steel case, new in maker's carton. Our Price £8.15.0 carr. free. Trade Terms for quantities.
R.109 RECEIVERS. Complete 79/6. P. & P. 10/-.
BATTERY CHARGERS, 6 or 12v. 4 amp. 79/6. P. & P. 4/6.
ACCUMULATORS. Celluloid 2v. 7 amp. New 7/6. P. & P. 1/6.
SWITCH BOARDS with 16 Toggles, new 4/6. P. & P. 1/3.
12V. 4A. SELENIUM RECTIFIERS. 14/3. P. & P. 1/6.
6V. 1A. SELENIUM RECTIFIERS. 4/3 P. & P. 1/-.
CANADIAN MARCONI No. 9 RECEIVERS. 2 Channel 1.9-5 Mc/s. 10 valves. B.F.O. BRAND NEW. 95/-. P. & P. 15/-.
1,000 Bargains for callers!
WEST END RADIO LTD.
14, LISLE STREET, LEICESTER SQUARE, LONDON, W.C.2.
Phone: GER 7341
OPEN ALL DAY SATURDAY!

WANTED, EXCHANGE, ETC.

WANTED, tuning units, TN17, TN18, TN19, for R54/APR4, £50 each offered.—Box 4963. [0261

WANTED, Aerial tuning units B.C. 939s.—P.C.A. Radio, Beavor Lane, Hammersmith, W.6. [0080

ABOUT 50 infra-red receivers, Type No. 5c/2246 or similar equipment; also separate converter cells, perfect condition only.—Box 0617 [4007

WANTED, set manufacturers' or ex-Government radio equipment, large or small quantities of valves, electrolytics, speakers, meters, also components.—LOWE BROS., 9a, Diana Place, Euston Rd., N.W.1. Eus. 1656/7. [2705

WANTED, BC 610 hallicrafters, ET 4336 transmitters, AR 88 Ds and LFs receivers and spare parts for above, also BC 221 frequency meters; best prices.—P.C.A. Radio, Beavor Lane, Hammersmith, W.6. [0029

ALWAYS buying scrap mercury contacts, platinum, all kinds of scrap, high-grade and non-ferrous scrap metals and scrap precious metals, any form; top prices.—Belgrave Buyers (W), 5, Belgrave Gardens, London, N.W.9. Mal. 7813. [3971

WANTED, signal generators types TF146, TF590G, TF762A, frequency meters BC221, TS174, TS175; also receivers types AR88, etc., APR4 or similar.—Send price and details to Hatfield Instruments, Ltd., 175, Uxbridge Rd., Hanwell, W.7. Tel. Ealing 0779/9857. [0037

VALVES WANTED

ALL types of valves required for cash; state quantity and condition.—Radio Facilities, Ltd., 38, Chalcot Rd., N.W.1. Primrose 9090. [5906

CABINETS

LEWIS RADIO have the best selection and finest finish.—See page 150. [0224

CABINETS made to order; Bass reflex speaker cabinets, all types and finishes.—See display advertisement, page 156. A. DAVIES & Co. (Cabinet Makers), 5, Parkhill Place, off Parkhill Rd., Hampstead, N.W.3. Gulliver 5775 [4001

WALNUT radiogram and television cabinets, soundly constructed; stamp for details.—R. Shaw, 69, Fairlop Rd., Leytonstone, E.11. [3193

METERS WANTED

WE urgently require meters of all types, meter components, test equipment, etc.; any quantity, large or small; prompt cash.—ANDERS ELECTRONICS, Ltd., 91, Hampstead Rd., London, N.W.1. Euston 1639 [3750

REPAIRS AND SERVICE

MAINS transformers rewound, new transformers to any specifications.
MOTOR rewinds and complete overhauls; first-class workmanship; fully guaranteed.
P.M. ELECTRIC Co., Ltd., Potters Bldgs., Warser Gate, Nottingham. Est. 1917. Tel. 47058. [0115

LOUDSPEAKERS repaired promptly.—Model Loudspeaker Service, Bullingdon Rd., Oxford. [3690

MAINS transformers, E.H.T.s, chokes, field coils, etc., promptly and efficiently rewound or manufactured to any specification.—LADBROKE REWIND SERVICE, LTD., 620a, Harrow Rd., London, N.W.10. [0222

TRANSFORMER rewind service, mains, E.H.T. transformers and chokes, prompt delivery, range of replacement types ex-stock or manufactured to your specification.—METROPOLITAN RADIO SERVICE Co., 75, Kilburn Lane, London, W.10. Ladbroke 2296. [0200

24-HOUR service, 6 months' guarantee, any transformer; rewind, mains outputs and L.T.s., etc.; all types of new trans., etc., supplied to specification; business heading or service card for trade prices.—Majestic Winding Co., 140, Windham Rd., Bournemouth. [2586

ELECTRICAL test instruments repaired and recalibrated, all makes, ammeters, voltmeters, multi-range test meters; meters supplied or converted to any range.—Electrical Instrument Repair Service, 329, Kilburn Lane, W.9. Ladbroke 4168. [4016

D.C. BOULTON for repairs to any loudspeaker; specialists on heavy and P.A. types; cone assemblies, field coils, repair accessories, pressure units, microphones; transformers rewound and to specification; motor rewinds.—Lumby St., Manchester Rd., Bradford. Tel. 22836. [0171

AS professional sound recordists and members of the Association of Professional Recording Studios, we are particularly well qualified to give advice and service on all aspects of sound recording and reproduction, circuits designed, prototypes built, repairs and modifications carried out quickly and thoroughly.—CALLERS by appointment only, please.—ARIEL SOUND, 57, Lancaster Mews, London, W.2. Tel. Paddington 5092. [0026

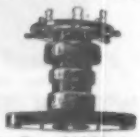
ARMATURE rewinding service to the trade, vacuums, drills, grinders, hood dryers, dental motors, vacuum cleaner armatures replaced from stock; 24 hours' service; every job guaranteed; we also specialize in complete overhauls and rebuilds of vacuum cleaners; all vacuum cleaner parts, hoses, bearings, fans, brushes for any make in stock.—Regam Electric, 95, Park Lane, Leeds, 1. [0028

COPPER WIRE

SWG	ENAMELLED 2 oz.	ENAMELLED 4 oz.	TINNED 2 oz.	TINNED 4 oz.
16	1/4	2/-	1/4	2/-
18	1/4	2/2	1/4	2/2
20	1/5	2/4	1/5	2/4
22	1/6	2/6	1/6	2/6
24	1/7	2/8	1/7	2/8
26	1/8	2/10	1/8	2/10
28	1/9	3/-	1/9	3/-
30	1/10	3/2	1/11	3/5
32	1/11	3/4	2/1	3/8
34	2/-	3/6	2/3	4/-
36	2/1	3/8	2/6	4/5
38	2/3	4/-	2/9	4/11
40	2/5	4/4	3/-	5/6

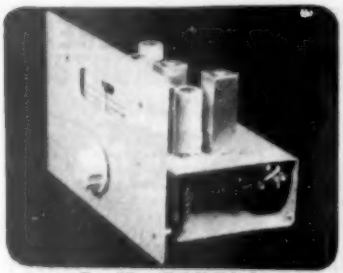
Wires to 48 SWG available.
COPPER INSTRUMENT WIRE
ENAMELLED, TINNED, LITZ, COTTON AND SILK COVERED.
All gauges available.
B.A. SCREWS, NUTS, WASHERS, soldering tags, eyelets and rivets.
EBONITE AND BAKELITE PANELS, TUFNOL ROD, PAXOLIN TYPE COIL FORMERS AND TUBES.
ALL DIAMETERS.
SEND STAMP FOR LIST. TRADE SUPPLIED.
POST RADIO SUPPLIES
33 Bourne Gardens, London, E.4

TELETRON SUPER INDUCTOR COILS
FERRITE ROD AERIALS.



Dual wave 12/9. MW. 8/9.
Wound on high permeability Ferroxcube Rod.
Selective crystal diode coil. Type HAX, 3/-. HAX.L for L.W. 3/6. Dual wave TRF coils (as illustrated), matched pairs, 7/-. I.F.T's. Transistor coils, etc., etc.
Stamp for circuits and data
THE TELETRON CO. LTD.
266, Nightingale Road, London, N.9.
HOW. 2527
Trade enquiries to sole distributor. SAM MOZER
91, Kendal Avenue, N.18. Edm. 7701

The Mullard 5 Valve 10 Watt HIGH QUALITY AMPLIFIER
as demonstrated at the Radio Show
can now be heard at
Smith's of EDGWARE ROAD
Component Specialists since Broadcasting started
who can supply all the parts for under £8
(less valves)
Priced parts list available
Full details are contained in a booklet by Mullard technical experts, price 2/6 from:
H. L. SMITH & CO. LTD.
287/289 EDGWARE ROAD, LONDON, W.2
Telephone: Paddington 5891
Hours 9 till 6 (Thursday 1 o'clock)
Near Edgware Rd. Stations, Metropolitan & Bakerloo



F·M·TUNERS

Basic Model " A," is thoroughly proven in sensitivity, stability and reliability. Early deliveries are being maintained. These are in use from Bognor to Ely.

Incorporating electrical and mechanical band-spread, unique tapped-down oscillator (crystal stability), and preset matching control. Closely to the Amos & Johnstone design. Additions include a modern hammer-finish frontplate, " 3-D " scale, and latest magic eye.

The kit version uses the same new miniature VHF type components. Fully worked chassis is stove enamelled, and wound tested coils are included, it is complete with valves, even nuts and bolts.

F.M. with really sensitive Medium Wave reception is possible with the CB4 double superhet. Incorporates variable de-emphasis, variable matching, ferramic rod aerial, mains power supply. Single or push-pull output can be added. A " hand built " BEL product.

Model " A "	£11 17 6
" A " kit	£7 5 0
" A " tuning scale, magic eye	£2 0 0
Standard power unit	£3 0 0
Aerials, 5/- and	£1 10 0
CB4, less output stage, mains driven	£31 0 0
" B " local station receiver	£10 0 0

Hear all these, our new Mullard amplifier and our transistor receiver, at

BEL SOUND PRODUCTS CO., MARLBOROUGH YARD N.19.
Short walk Archway stn., 25 mins. from West End.
Ring ARC 5078.

OPPORTUNITIES IN RADIO

Get this FREE Book!

'ENGINEERING OPPORTUNITIES' reveals how you can become technically qualified at home for a highly paid key-appointment in the vast Radio and Television Industry. In 144 pages of intensely interesting matter, it includes full details of our up-to-the-minute home study courses in all branches of **TELEVISION and RADIO, A.M. Brit. I.R.E., City & Guilds, Special Television, Servicing, Sound Film Projection, Short Wave, High Frequency and General Wireless Courses.**

We definitely Guarantee

"NO PASS—NO FEE"

If you're earning less than £15 a week this enlightening book is for you. Write for your copy today. It will be sent **FREE** and without obligation.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY
388B COLLEGE HOUSE,
29-31, WRIGHT'S LANE,
LONDON, W.8.

BIET

REPAIRS AND SERVICE

SERVICE sheet for hire or sale over 2,000 models, radio and television, 1st 1/-; s.a.e. enquiries.—W. Gilbert, 24, Fillhville Gardens, London, W.12. Tel. Sho. 3052. [3515

REWINDS, mains transformers, chokes. E.H.T.s, outputs frame and line opt's fields solenoids, R.F., E.H.T. coils, etc.; new types including " C " cores, designed to specification; your enquiries will receive prompt attention.—Melton Metallurgical Laboratories, Ltd., Transformer Section, 387-9, Ashley Rd., Parkstone, Poole, Dorset. [3998

PAINTS, CELLULOSE, ETC.

PAINT spraying handbook, 5/6 post free, cellulose and synthetic paints and all spraying requisites supplied; catalogues free.—Leonard Brooks, 53, Harold Wood, Romford. [0207

WORK WANTED

A.I.D. approved Govt. contractors seek work.—Brl, London, N.19. Arc. 5078. [0183

ELECTRONIC equipment made to order; wiring assembly contractors, prototypes developed.—R.A.E. Mfg. Co., 135a, Kentish Town Rd., N.W.1. Gul. 7011. [0219

CAPACITY AVAILABLE

VACUUM impregnation capacity available, Hadfields Solventless to RC.6214 Specification.—Enquiries to, Avis & Baggs, Ltd., Goldbrook Rd., Caversham, Reading. Tel. 71765. [0094

MISCELLANEOUS

HIGH fidelity L.P.s from your own tapes, our experience saves your money. " EROICA " Recording Services (Regd. 1949), 91, Peel St., Eccles, Manchester. ECCLES 1624. Director: Thurlow Smith, A.R.M.C.M. [0121

METALWORK, all types cabinets, chassis, racks, etc., to your own specification; capacity available for small milling and capstan work up to 1in. bar.—PHILPOTT'S METAL WORKS, Ltd. (G4BI), Chapman St., Loughborough. [0208

FRAMES D. & P. 10 wire MK. 5 sets, ref. no. YA.6562; quantity available; accept 10/- per set for minimum quantity of 50.—Box 0740. [3986

DAVENSET HT3 high voltage battery charger, 3 independently controlled circuits suitable AC240, recent complete maker's overhaul; £20 o.n.o.—Waterloo Garage, 5-7, Coral St., S.E.1. [4045

YOUR own tape recording transferred to disc.—Write, call or 'phone Queensway Private Recording Studios, 125, Queensway, W.2. Tel. Bay. 4992. Studio recordings, tape recording service. [4008

BUILD your own TV and learn about its operation, maintenance and servicing; qualified engineer-tutor available whilst you are learning and building.—Free brochure from E.M.I. Institutes, Dept. WW.58, London, W.4. (Associated with H.M.V.) [0180

COPPER wires enamelled, tinned, Litz, cotton, silk covered, all gauges; B.A. screws, nuts, washers, soldering tags, eyelets, ebonite and laminated bakelite panels, tubes, coil formers; Tufnol rod, headphones, Bases, etc.; latest radio publications, full range available; list, s.a.e.; trade supplied.—Post Radio Supplies, 33, Bourne Gardens, London, E.4. [0136

NOTICES

BRITISH SOUND RECORDING ASSOCIATION. Details of membership, open to the professional sound recording engineer and all others interested in recording high quality reproduction and the branches of audio engineering, together with details of the London lecture programme and the Manchester, Portsmouth and Cardiff Centres, may be obtained from the Hon. Membership Secretary, H. J. Hougate, A.M.I.E.E., 12, Strongtow Rd., Eltham, S.E.9. [0031

PATENTS

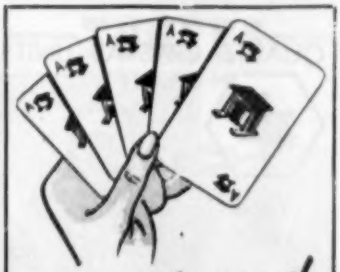
THE proprietor of British Patent No. 573515 entitled " Multiple section electronic tube and method of making it," offers same for licence or otherwise to ensure practical working in Great Britain.—Enquiries to Singer, Stern & Carlberg, 148, Jackson Blvd., Chicago 4, Illinois, U.S.A. [3926

SITUATIONS VACANT

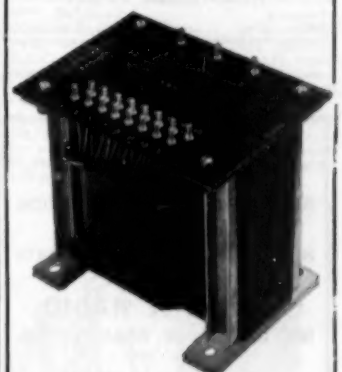
The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order, 1952.

ADVERTISEMENT for

RADIO and Television Repairer Instructor. RADIO and Television Repairer Instructor, Letchworth Government Training Centre. Unestablished post. Should possess thorough knowledge of basic radio and television theory combined with considerable practical experience of fault-finding, alignment, adjustment and servicing of commercial radio and television receivers. Able to instruct from first principles and to demonstrate use of bench tools and repair of components. Commencing salary, age 28 and over, £420 p.a. less for each year below 28; —£550 p.a. rising to £640 p.a. 18 days' annual leave with pay.—Apply Ministry of Labour and National Service, Employment Exchange, Letchworth. [3977



Nap hand and all aces



Bouquets praising the excellence of Savage Transformers continue to reach us from enthusiastic users all over the world.

" Thank you for making the transformer on order 7/1384 so quickly. The transformer has been tried out and is working satisfactorily."
B. E. A. Southgate.

" After getting home the first thing I did was to install the transformer and I must say that it is more than satisfactory."
R. A. K. Johannesburg.

" In April 1951 you supplied me with a 2B36B output transformer which has given me every satisfaction on my Williamson amplifier."
G. T. R. Leeds.

" The writer purchased one of your mains transformers in 1930 when your promises were somewhere around Clerkenwell. It has been in continual service since that date and when last seen was still functioning perfectly at Lancing."
G. E. Southampton.

" Your unit arrived in good condition and caused a minor sensation when unpacked. The audio chap there said ' That is the kind of service you dream about but seldom get.' "
D. M. Toronto.

SAVAGE TRANSFORMERS LIMITED DEVIZES

Nursteed Road, Devizes, Wilts.
Tel. : Devizes 932

QUARTZ CRYSTAL UNITS

Type B7

The type B7 unit is mounted in the standard B7G valve envelope and is hermetically sealed and fully evacuated.
Available for the frequency ranges from 100 kc/s to 500 kc/s, and from 3 Mc/s. to 15 Mc/s. Gold electrodes applied by cathodic sputtering give permanence of calibration. Normal adjustment accuracy 0.01% Max. adjustment accuracy 0.003%

Early delivery can be given on some frequencies, and we will be pleased to quote on your specific requirements.

THE QUARTZ CRYSTAL Co. Ltd
63-71 Kingston Road,
NEW MALDEN, SURREY
Telephone: MALden 0334 Cables, etc.: QUARTZCO NEWMALDEN

THE OSRAM NINE-ONE-TWO
AMPLIFIER INSTRUCTION BOOK
and
HIGHEST QUALITY COMPONENTS
Available from
COVENTRY RADIO
189, DUNSTABLE ROAD, LUTON.
'Phone: 2677.
Price 3/6, plus 3d. postage
also
Our 1954-5 Component Catalogue at 1/-

Good Investments

SEWING MACHINE MOTORS. New and guaranteed, radio suppressed, 230 volts A.C./D.C., with fixing bracket, foot control and needle light, £6/10/-. Carr. 2/6.

BATTERY CHARGERS. The Lesdix "NITNDAY" Battery Charger keeps your accumulator in good order during the winter months. Double wound transformer, metal rectifier wired in vent. metal case with Ammeter and terminals; for use on 230 volt A.C. 50 cycle supply, output 12 volts 4 amps., 85/-, carr. 3/6, or 6 volts 3 amps., 75/-, carr. 3/6.

FLEXIBLE DRIVES for small motors, 7ft. long, 5/6, post 1/-.

TERRY ANGLEPOISE LAMPS for drawing boards or Workshop wall or machine fixing. Will stay in any position; new, with S.C.C. Lampholder, flex and shade, 35/-, post 2/6.

REPAIRS to Variable Slider Resistances and Motor Starters; best quality resistance wires used, prices moderate.

Leslie Dixon & Co.
Dept. A, 214 Queensbury Road, London, N.W.9
Telephone: MACaulay 2159

SITUATIONS VACANT

ULTRA ELECTRIC, Ltd.,
WESTERN Ave., Acton, London, W.3.
RADIO & television development engineers.
(a) APPLICATIONS are invited from senior development engineers with experience and academic qualifications for important work on new development projects.
THE posts are permanent and pensionable and offer scope for the right men to work in ideal conditions in modern, well-equipped laboratories.
PLEASE write in strict confidence to the Personnel Manager for an interview appointment.
(b) JUNIOR engineers (aged 21/29) are also required, and applicants for these posts should have some technical training and preferably previous experience. Please write as above. [3572

ULTRA ELECTRIC, Ltd.,
WESTERN Ave., Acton, London, W.3.
ELECTRONIC development engineers are required in all grades, for work on: (a) subminiaturisation of VHF, radio and audio circuitry; (b) transistor applications; (c) VHF communication; (d) pulse techniques; (e) radar and radio navigation.
APPLICATIONS are invited from:—
(a) SENIOR development engineers with degree or equivalent qualifications, and more than five years' experience in one or more of the above fields.
(b) JUNIOR engineers with degree or HNC with or without experience for work in the above fields.
(c) TEST equipment development engineers with experience of design of test equipment to meet production requirements.
THE posts are permanent and pensionable, and offer scope for the right men to work in ideal condition, in modern, well-equipped laboratories.
PLEASE write, in strict confidence, to the Personnel Manager for an interview appointment. [3573

A. V. ROE & Co., Ltd.,
WOODFORD Aerodrome, Cheshire.
HAVE vacancies in their newly formed
WEAPONS Research Division
AERODYNAMICISTS.
WITH Honours Degree in Physics, Mathematics or Engineering and at least two years experience are required to work on an aerodynamics group on aerodynamic theory and analysis of new weapon projects. Candidates should be familiar with supersonics.
MATHEMATICIANS.
WITH Honours degree to work on flight dynamics and studies of control systems, a knowledge of numerical mathematics would be an advantage.
ELECTRONIC Engineer.
A graduate with research and development experience in electronics or with electro-mechanical devices.
GOOD salaries and prospects
PENSION and life assurance scheme.
APPLY giving full particulars of academic training and experience to:—
A. V. ROE & Co., Ltd.,
WEAPONS Research Division,
WOODFORD, Cheshire. [3559

ELECTRONIC Technicians.
APPLICATIONS are invited for radar and electronic technicians for appointments as civilian technical assistants Grade III. telecommunication mechanics or electricians with R.E.M.E. in Anti-Aircraft Command in the Newark area.
(a) TECHNICAL assistants should hold Ordinary National Certificate in Electrical Engineering or equivalent qualification, or be a former armament artificer R.E.M.E., foreman or sergeants Royal Signals C.P.O., Royal Navy or senior N.C.O. R.A.F., with service radar or electronic qualifications; starting salary at 25 is approx. £520 p.a., by £20 increments up to £600 p.a.
(b) TELECOMMUNICATION mechanics and electricians should have had several years' experience in the repair of wireless and line equipments; weekly wage of approx £7/7 plus proficiency pay of up to 30/- per week.
ALL applications should be submitted to A.D.M.E. H.Q. 5 A. Group, "Coverlands," Newdigate Lane, Kimberley, Nottingham, stating age, qualifications and experience. [3595

DRAWING office training.
MARCONI'S WIRELESS TELEGRAPH Co. Ltd., have vacancies at their Drawing Office school as from February 1955 onwards. A six months course with fixed salary at the Drawing Office School, Chelmsford.
AFTER successful completion, permanent posts will be available in the Company's Design Drawing Offices at Chelmsford. A few posts will be available at Acton, London.
QUALIFICATIONS: Age limit 28. Must have workshop experience. Must produce evidence of drawing ability. Preferably have O.N.C. Mech or E.ec.
A limited number of posts will be available, after training, in the Company's Installation Drawing Offices at Chelmsford. Men with practical experience in the installation and maintenance of electrical equipment would be preferred for these posts.
FIVE-DAY week. Pension and Life Assurance Scheme. Social and Athletic Club.
APPLY (in writing) giving full details of education, training, experience, etc. (including H.M. Forces), to The Secretary, Marconi's Wireless Telegraph Co., Ltd., New St., Chelmsford, Essex. [4056

ODDIE FASTENERS

Pat. 50724

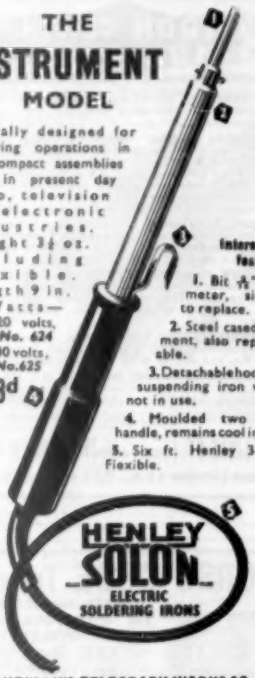
THIS FASTENER WITH ENDLESS APPLICATIONS—SIMPLE—POSITIVE SELF-LOCKING. MADE IN A VARIETY OF TYPES AND SIZES.
SPECIAL FASTENERS TO SUIT CUSTOMERS' REQUIREMENTS.
WIDELY USED IN THE RADIO INDUSTRY.
Illustrated brochure and other information will be gladly sent on request.
DEPT "W.W."
Oddie, Bradbury & Cull Ltd., Southampton
Tel.: 55 83 Cables: Fasteners, Southampton

ENGINEERS!

Whatever your age or experience, you must read "ENGINEERING OPPORTUNITIES." Full details of the easiest way to pass A.M.I.Mech.E., A.M.I.C.E., A.F.R.Ae.S., A.M.I.E.E., A.M.I.Chem.E., A.M.I.Prod.E., A.M.I.Struct.E., A.M.I.W.E., A.M.I.H.V.E., A.M.I.Mun.E., A.M.I.Min.E., A.M.I.Gas E., A.M.I.Fire E., A.M.I.Plast.E., A.M.I.R.I.A., A.M.I.Mar.E., A.M.I.Loco.E., A.M.I.Heat.E., A.M.I.Ceram.E., A.M.I.Sanit.E., A.M.I.Agric.E., A.M.I.Coach.E., A.M.I.Weld., A.M.I.Foundry.E., A.M.I.Shipbuilders, A.M.I.Prod.E., A.M.I.Works M., A.M.I.Cost & Works Accountants, A.M.I.Plant E., A.M.I.Rubber Tech., A.M.I.Fuel, A.M.I.Ceramic Tech., A.M.I.Brit.F., A.M.I.Quar.E., A.M.I.Petroleum Tech., A.M.I.Water E., A.M.I.Inst.M., A.M.I.Inst.P., A.M.I.Inst.F., A.M.I.Inst.R., A.M.I.Inst.Pkg., A.M.I.Inst.Met., A.M.I.Inst.Supervisory Management, A.M.I.Inst.Welding, A.M.I.Inst.Quality Control, A.M.I.Inst.Sales Engineers, A.M.I.Inst.Asbestos Technology, A.M.I.Inst.Vitreous Enamellers, A.M.I.Inst.Ceramics, A.M.I.Inst.Refrigeration, A.M.I.Inst.Cast Metals Technology, A.M.I.Inst.Corrosion Technology, A.M.I.Inst.Metal Finishing, A.M.I.Inst.Metallurgists, A.M.I.Inst.Marketing, A.M.I.Inst.Industrial Management, A.M.I.Inst.Fuel, A.M.I.Inst.Rubber Industry, A.M.I.Inst.Plastics, A.M.I.Inst.Petroleum, A.M.I.Inst.Water Engineers, A.M.I.Inst.Quarrying, A.M.I.Inst.Building, A.M.I.Inst.Clerks of Works, A.M.I.Inst.Journalists, A.M.I.Inst.Transport, A.M.I.Inst.Wastes Management, A.M.I.Inst.Operational Research, A.M.I.Inst.Hospital Engineering, A.M.I.Inst.Navigation, A.M.I.Inst.Measurement & Control, A.M.I.Inst.Road Transport Engineers, A.M.I.Inst.Sound & Vibration Technology, A.M.I.Inst.Physical Distribution Management, A.M.I.Inst.Personnel Management, A.M.I.Inst.Production Engineers

THE
INSTRUMENT
MODEL

Specially designed for soldering operations in the compact assemblies used in present day radio, television and electronic industries. Weight 3½ oz. excluding flexible. Length 9 in. 25 Watts—
200/220 volts, *LIST No. 624*
220/240 volts, *LIST No.625*
19/8d



Interesting features
1. Bit ⅛" diameter, simple to replace.
2. Steel cased element, also replaceable.
3. Detachable hook for suspending iron when not in use.
4. Moulded two part handle, remains cool in use.
5. Six ft. Henley 3-core Flexible.

HENLEY SOLON ELECTRIC SOLDERING IRONS

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.
51/53, Hatton Garden, London, E.C.1

THE
Cape 25
AUDIO AMPLIFIER

One Pound Per Watt

One of the many features of this amplifier is its extreme linearity. Measurements made by The Southampton University upon a standard production model show the total harmonic distortion to be:—

0.1% AT **28** WATTS
and less than
0.05% AT **25** WATTS

These figures are an indication of the excellence of the circuitry and the quality of the components used.

25 WATTS - **£25**

For brief specification see "Wireless World," January, 1955, page 157.

Write for full particulars to:
CAPE ELECTROPHONICS LTD.
43-45 SHIRLEY HIGH ST., SOUTHAMPTON
Telephone: Southampton 74051

SITUATIONS VACANT

ELECTRONICS Engineers.
VACANCIES exist in the expanding electronics division of Saunders-Roe, Ltd. The range of work is unusually wide and interesting, covering design and development of analogue and digital computers, electro-mechanisms, measuring apparatus, strain gauging equipment and techniques, etc. Salaries offered are commensurate with qualifications and experience. Assistance will be given with accommodation.
WRITE stating age, experience, etc., or send P.C. for application form to the PERSONNEL Department (Ref. WW/17), Saunders-Roe, Ltd., East Cowes, I.o.W. [3929

LONDON COUNTY COUNCIL.
NORWOOD Technical College, April, 1955: Assistant Grade B to teach telecommunications subjects to C. & G. Full Tech. Cert. standard; additional television advantage; must have degree or equivalent, together with teaching and/or industrial experience; salary within the scale £565×£25—£964 plus London allowance £58 or £48, commencing and maximum salary according to age, qualifications and experience.—Application forms from Secretary at College, Knight's Hill, S.E.27, returnable by February 12 (1655). [4018

MURPHY RADIO require:—
1. SENIOR Radio Receiver Designer.
2. INDUSTRIAL Chemist with previous experience of plating and finishing processes; the applicant will be in charge of the chemistry laboratory and should be able to deal with all chemical problems arising out of radio and television design and productions.
3. VERSATILE Engineer with sound knowledge and previous experience of component design and application and well versed in quality control and life test methods; thorough knowledge of plastic materials and good theoretical background an advantage.
APPLICATIONS stating which vacancy referred to and giving details of age, experience, qualifications and salary should be addressed to—Personnel Department (A.L.), Murphy Radio, Ltd., Welwyn Garden City. [4005

DRAUGHTSMEN and designers.
E. K. COLE, Ltd., Ekco Works, Southend-on-Sea, have the following vacancies:—
MOULD designers and jig and tool draughtsmen for the plastics division.
ELECTRONIC, radio and television designers and draughtsmen for development and engineering departments.
MECHANICAL draughtsman for plant layout in the production engineering department.
APPLICATIONS to the Personnel Manager, Southend-on-Sea 49491. [4026

METHODS development section of Pye, Limited, has
VACANCIES for senior and junior television circuitry engineers and mechanical development engineers to work on printed circuit and other new system developments, this is work in a new and expanding field and offers almost unlimited scope for engineers with drive and initiative; salaries dependent on qualifications and experience.—Apply to Chief Television Engineer, Pye, Ltd., Cambridge. [3994

TECHNICAL Instructors (telecoms) for work with
ROYAL SIGNALS (Civilian Establishment). Vacancies exist at 1 Training Regiment Royal Signals for unestablished Grade III Instructors (with prospect of eventual establishment). Successful applicants will be required to undertake interesting and varied instructional duties in the fields of electronics and the basic principles of radio and/or line communications. Salary scale: £510×£20—£640. Commencing salary according to age. Liberal leave.
APPLICANTS should have a sound knowledge of radio and/or VF telegraphy and carrier telephony. Academic qualifications are not essential, but O.N.C. or City and Guilds Certificates would be an advantage. Training in instructional techniques would be given to successful applicants. Apply to:
THE Chief Instructor, 1 Training Regiment, Royal Signals, Catterick Camp, Yorkshire. [4032

TECHNICAL Instructor (HF and VHF radio) required for
POSTS and Telegraphs Dept., Nigerian Federal Govt., for one tour of 12 to 24 months in the first instance. Appointment either (a) on contract with salary scale (including expatriation pay) £807 rising to £1,269 a year with gratuity at rate of £100/£150 a year, or (b) with prospect of permanency with salary scale (including expatriation pay) £750 rising to £1,175 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for maintenance in U.K. Liberal leave on full salary. Candidates must have extensive experience in G.P.O. or with firm of electrical manufacturers in installation and maintenance of HF and VHF radio telephone links.—Write to the Crown Agents, 4, Millbank, London, S.W.1, quote age, name in block letters, full qualifications and experience, and quote M2C/40524/WF. Candidates at present employed by the General Post Office should submit their applications through their Establishment Division. [4033

ELECTRONIC development engineers required for work on industrial electronic nucleonics, X-ray and electro-medical apparatus. Good conditions and pension scheme operating.
APPLY to: General Radiological, Limited, Chief Engineer, 15, Clipstone St., W.1. [4036

—TUNERS—
V.H.F./FM

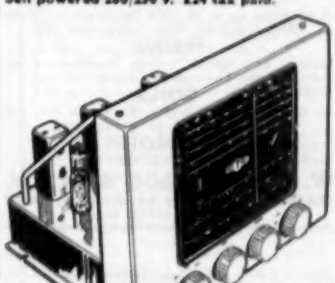
FM81

Excellent reproduction with absence of background noise provides an amazing degree of realism when used with Wide Range reproduction equipment

The FM81 uses the latest valves and techniques; Tuned R.F. stage; Frequency Changer; 2 I.F. stages; Ratio Discriminator; A.V.C.

Tunable between 87.5 Mc/s.-100 Mc/s., the FM81 will receive the proposed National B.B.C. frequency modulated V.H.F. transmissions as and when installed within approximately 60 miles from the transmitter. £21 tax paid.

Type F.M.82 similar to above, but with preset station selection, separate trimmer for each position. Range of each position 87 Mc/s.-100 Mc/s. Output 2 volts approx Self powered 200/250 v. £24 tax paid.



S6BS

S6BS 9 Band (6 Electrical band spread) with R.F. F.C 2 I.F. Delayed Amplified A.V.C. Variable Selectivity. Fly Wheel Tuning. Tropicalised. Suitable for use with any High Quality Amplifier. **£44.** Tax paid.

S6 A new model similar to the well-known S6BS but only 3 Wave Bands: 16m-50m, 195m-550m, 800m-2,000m. **£30.** Tax paid.

S6E As S6 but 4 Wave Bands: 12.5m-37m, 35m-100m, 90m-250m, 190m-550m. **£30.** Tax paid.

S5 3 Wave Bands, 16m-2,000m, R.F. pre-Amplifier, variable selectivity I.F. Delayed Amplified A.V.C. very low distortion. **£21/6/8.** Tax paid.

S5E As S5 but 12.5m-550m. **£21/6/8.** Tax paid.

S4 The Standard high-quality Feeder Unit Specification as S5 but without R.F. amplifier. **£16.** Tax paid.

A modified version of all models is available for use with Leak, Acoustical and other High Quality Amplifiers.

C. T. CHAPMAN (Reproducers) LTD.
RILEY WKS., RILEY ST., CHELSEA, S.W.10
FLAxman 4577/8
Export Enquiries Invited

Introducing the :—

TYANA TRIPLE THREE

Reg. Design No. 867884

MAKE SOLDERING A PLEASURE

SMALL SOLDERING IRON

Complete with detachable BENCH STAND **19/6**

The smallest high-power soldering iron. Length only 8½in.; adjustable long bit dia. 3/16; mains voltages 100/110, 200/220, 230/250.

The "STANDARD"

Popular Soldering Iron

now reduced to 14/11

Replacement Elements and Bits for both types always available.

KENROY LIMITED

152/297 UPPER ST., ISLINGTON LONDON, N.1.

Telephone : Canonbury 4905-4663

A.T.D. INDUCTA Approved

TRANSFORMERS

of all types up to 25 KVA for Single or Three Phase operation. Phase Conversion, etc.

MAINS

Output, and Special Purpose Transformers for Radio Equipment; Chokes, etc.

COILS

for Contactors, E.M. Brakes, Air Valves, etc., and Coil WINDINGS for all purposes.

SOLENOIDS

for A.C. and D.C. Operation.

W. F. PARSONAGE & Co., Ltd.

INDUCTA WORKS · Park Rd · Bloxw.ch · Walsall

Telephone: BLOX 66464

THE

DESIGN and DEVELOPMENT

of specialised equipment for Research and Industry.

DUN-SOBIESON ELECTRICAL CO.,

17 Victoria Gardens, London, W.11. *Park 6636*

BASS REFLEX CABINETS

Walnut, Mahogany or Oak, 32" high, with gold anodised expanded metal grille.

12" Speaker Model £10. 0.0
10" " " £9.10.0
8" " " £9. 0.0

Carr. paid

GOODMANS & G.E.C.

Full range of cabinets for these speakers.

You can see your cabinet being made in our cabinet-making workshop.

Cabinets made to order.

Armstrong Chassis and Amplifiers.

The Leak TL/10 Amplifier.

LOUDSPEAKERS.

Open till 5.30 Saturdays

A. DAVIES & Co. (Cabinet Makers)

3 Parkhill Place, off Parkhill Road, London, N.W.3. GULLIVER 3775.

SITUATIONS VACANT

WIRELESS station superintendents required by the NIGERIA Posts and Telegraphs Department for one tour of 18 to 24 months in the first instance. Option of appointment (a) on temporary terms with salary scale (including expatriation pay) £584 rising to £1,592 a year. Gratuity at the rate of £100/£150 a year, or (b) with prospect of pensionable employment with salary scale (including expatriation pay) £750 rising to 1,175 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for maintenance in U.K. Liberal leave on full salary. Candidates must have had wide practical experience of modern radio technique and equipment, in particular V.H.F. Equipment, and preferably also V.H.F. multi-channel equipment. WRITE to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/30086/WF. [4057

BURNDEPT, Ltd. have vacancies, due to expansion, for:

1. Telecommunications Development and Research Engineers. Qualified to operate as Project Leaders under direction of Chief Engineer on Government and proprietary designs. Experience must be within one or more of the following fields:—

(a) Aeronautical Telecommunications, both airborne and ground station designs, with special emphasis on U.H.F. techniques within this field.

(b) P.M. single- and multi-channel equipment development in both V.H.F. and U.H.F. bands.

(c) Development of subminiaturisation techniques and special components.

2. Telecommunications Laboratory Instrument Mechanics and Wiremen.

MUST be fully conversant with modern miniature and subminiaturisation techniques, and be able to wire from circuit diagrams on own initiative. Those capable of converting experimentally wired models to final stage by own initiative will receive special consideration. Excellent working and model shop facilities.

APPLICATIONS giving full particulars, including present salary, should be sent in confidence to Personnel Manager, Burdept, Ltd., Erith, Kent. [3980

SHORT BROTHERS & HARLAND, Ltd., Belfast, require a laboratory superintendent for their research department.

THE position involves responsibility for providing equipment, supplies and services in the laboratories; also control of laboratory personnel.

CANDIDATES should possess organising ability, and be familiar with the running of a laboratory or workshop.

EXPERIENCE in light electrical equipment or precision instruments essential.

CONSIDERABLE tenacity and drive necessary to co-ordinate and sustain action with external official bodies.

THIS appointment is suitable for a retired officer of one of the technical branches of the Services.

ASSISTANCE with housing, and with removal expenses.

SEND full details of age, qualifications and experience, quoting Ref. 613/St. App., to Staff Appointments Officer, Short Bros. & Harland, Ltd., P.O., Box No. 241, Belfast. [5344

PERSONNEL required for employment by Canadian electronics company in Canada, as follows:—

TECHNICIANS.—Qualifications: Higher National Certificate in electrical engineering or City and Guilds Certificates in Radio Engineering, plus 5 years' experience in radar production, installation and servicing.

ENGINEERS.—B.Sc. or A.M.I.R.E., plus 5 years' practical experience in radar, preferably radar fire control.

APPLICANTS should be natural born British subjects.—Write, stating age, experience, full qualifications, to Box 0741. [3989

RADAR and Electronics.—Senior, intermediate and junior development engineers required. Salaries according to experience and ability. ALL-POWER TRANSFORMERS, Ltd., Chertsey Rd., Byfleet, Surrey. [5975

A. V. ROE & Company Limited have the following vacancies for electronic and mechanical engineers in their Weapons Research Division at Woodford:

(a) SENIOR Engineer with Honours Degree and considerable experience of development of electronic computers and simulators to take charge of a group developing guided weapon simulators.

(b) SENIOR Engineer with Honours Degree and considerable development experience to take charge of a group developing hydraulic and pneumatic servo and precision mechanical devices.

(c) A number of engineers with either Honours Degree in Physics or Engineering or appropriate research or development experience to work on guided weapon computing navigation and control systems.

SALARIES will be commensurate with ability and experience. Applications, giving full particulars of age, qualifications and experience, etc., should be addressed to: The Chief Designer, Weapons Research Division, A. V. Roe & Company Limited, Woodford, Cheshire. [5792

RADIO/TV service engineers for inside and outside work; attractive salaries and excellent prospects for right men; West-End and N.W. areas of London.—Apply Broadmead Wireless Co., 125, The Broadway, S.W.19. [4040

LONDON CENTRAL RADIO STORES

VOLTMETERS. Moving coil 0-12 and 0-120. Panel mounting with resistance complete 2½in. overall diameter, carr. paid, 8/-.

CHARGING BOARDS. Control Panel Only. 24 v., 1,250 watts. Includes five 1½in. moving coil ammeters (1, 0-40 a., 4, 0-15 a.). One moving coil voltmeter 0-40 v. Five heavy duty sliding resistances, etc., complete in metal case as shown with fold-back doors. Size, 18 × 17 × 9½in. Ocered at less than half the component value. Price, carriage extra, £4/10/0.

PHILCO RADIO SETS. 3-wave 5-valve. Fully reconditioned and tested. Incorporating 2 speed tuning. In walnut cabinet, A.C. or Universal Mains. Approx. size: 18 × 14 × 9½. £5/10/-. Carr. paid.

4-VALVE (Used) SUPERHET UTILITY RECEIVERS Fully reconditioned. Medium waveband only. 6½in. P.M. speaker. Complete in pinewood cabinet. Size 13½ × 12 × 6½. 200-250 A.C. mains. £3/18/6. Carr. paid.

CAMBRIDGE UNIPIVOT METERS. Range 0-60 microamperes. High grade laboratory instrument. Cu. Res. 12.4 ohms at 20°C. For Callers only. £7/10/-.

TRANS-RECEIVER TYPE 18. Mk. 3. H.T. 120 volt, L.T. 3 volt. Frequency 6-9 mcs. Complete in case with aerials, etc. Less mike and phones. £3/15/- carr. paid.

N.B.—Carriage charges relate to British Isles only

23 LISLE ST. (GER. 2969) LONDON, W.C.2

Closed Thursday 1 p.m. Open all day Saturday

MORSE CODE Training

COURSES for BEGINNERS and OPERATORS, also a **SPECIAL COURSE** for passing the **G.P.O. Morse Test** for securing an **AMATEUR'S TRANSMITTING LICENCE.**

Send for the Candler **BOOK OF FACTS**

It gives details of all Courses

Fees are reasonable

Terms : Cash or Monthly Payments

THE CANDLER SYSTEM CO

(56W) 52b ABINGDON ROAD., LONDON, W.8

Candler System Co., Denver, Colorado, U.S.A.

HIGH FIDELITY

COMPONENTS IN STOCK FOR THE

MULLARD 5-10

OSRAM 912 AMPLIFIERS

Price lists and 48 page catalogue free on request to

J. T. FILMER. MAYPOLE ESTATE, BEXLEY, KENT.

TEL: Bexleyheath 7207.

YOUR METER DAMAGED

Leading Electrical Instrument Repairers to the Industry

Contractors to the Ministry of Supply and General Post Office

epairs by skilled craftsmen of all makes and types of V-Meters, Ammeters, Microammeters, Multirange Test meters, Electrical Thermometers, Recording Instruments, etc. Quick deliveries—for speedy estimate send defective instruments by registered post to—

L. GLASER & CO.

Electrical Instrument Repairers

96-100 ALDERSGATE STREET, E.C.1

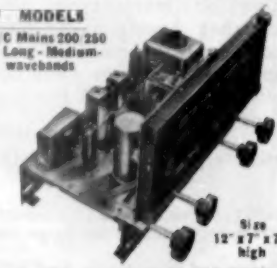
(Tel. : MONarch 6822)

DIRECT FROM THE MANUFACTURER

RADIO RADIOGRAM CHASSIS
Built to Highest Technical Standards

NEW MODELS

For A.C. Mains 200-250 volts Long - Medium - Short wavebands



Size 12" x 7" x 7½" high

OUTSTANDING PERFORMANCE	HIGH QUALITY REPRODUCTION

- Latest type miniature Valves.
- Gram switching on wavechange switch.
- Negative feedback applied from output transformer secondary.
- Plug-in sockets for pick-up, extra speaker. Gram motor.

MODEL F3, 5 valves 4 watt output, wide range tone control **£13.18.3**

MODEL F3, PUSHPULL, 7 valves, 6 watt output. Independent bass and treble controls **£17.17.9**

ALL CHASSIS FULLY GUARANTEED
Plastic Escutcheon 3/-. Matching Speakers available.
PARTICULARS FROM YOUR LOCAL DEALER OR

THE DULCI CO. LTD.
97 VILLIERS ROAD, LONDON, N.W.2.
Telephone Willesden 7778
DEALERS' ENQUIRIES INVITED.

"LAFCO"

EASY PAYMENT GUIDE
LOOK FOR US EVERY MONTH HERE

METRIX TEST METERS (see their Illustration—"Wireless World" November issue, page 114). **Model 410**, 19 ranges, **£9/3/11** or **22/4** deposit and 8 × **22/4**. **Model 460**, 25 ranges, **£14/6/4** or **35/-** deposit and 8 × **35/-**.

SOLDER THE "**PRIMAX**" WAY FOR **8/7** DEPOSIT and 8 monthly payments of **8/7**. (CASH PRICE **70/-**.)
(Instant Heating—ready for use in 6 seconds, and weighs only 23 oz.)
OTHER SOLDERING EQUIPMENT AS FOLLOWS:

HENLEY BOLON TYPE 625, 19/6 CASH OR 2/6 deposit and 8 monthly payments of **2/6**. 65 WATT TYPES, OVAL BITS, **23/6** CASH OR 2/11 and 8 × **2/11**. 125 WATT TYPES (OVAL BITS) **40/6** or 4/11 and 8 × **4/11**. 240 WATT TYPES (OVAL BITS ONLY) **60/-** or 8/1 and 8 × **8/1**.

SOLO SOLDER TOOL ready to be run off a 6-volt battery (car or m/cycle battery) **37/6** CASH or 4/7 deposit and 8 × **4/7**. The transformer is available to enable the tool to be run off 220-230 v. A.C. mains at an additional **28/5** or **3/6** and 8 × **3/6**. A combined De Luxe unit consisting of the Tool and Transformer permanently mounted and wired, in handsomely finished cartone, **85/-** or 10/5 and 8 × **10/5**. (s.a.e. for Leaflet.)

ADCOLA, **25/6** or **3/2** deposit and 8 monthly payments of **3/2**.

Also Handyman's tools as follows: **B. & D. ¼in.** Electric Drill **13/11** deposit and 8 monthly payments of 13/11 (**£5/19/6** CASH). ¼in. Electric Drill **KR** 27/11 and 8 × **27/11** (**£11/17/6**). Craftsman Lathe, **12/3** and 8 × **12/3** (**£5/8/-**). 5in. Sander Polisher **KR 23/-** and 8 × **23/-** (**£9/17/6**). (This list is not complete.)

Desk 117, LAFCO COMPOUNDS LTD.
3, CORBETTS PASSAGE, ROTHERHITHE NEW RD., S.E.16. BER 4341 (Ext. 1)

SITUATIONS VACANT

THE PLESSEY COMPANY has vacancies for development engineers familiar with one of the following subjects:—
(a) VARIABLE capacitors.
(b) SWITCHES for radio or electrical appliances.
(c) V.H.F. or U.H.F. circuits and tuning mechanisms.
(d) RELAYS and vibrators.
(e) LOUDSPEAKERS and acoustics.
A good salary and a progressive future are offered to men who can design components suitable for high production rates, while maintaining standards of quality and performance. There are also vacancies for qualified engineers and draughtsmen with less experience who will be able to undertake responsible design work after a period in the laboratory. All posts are permanent and pensionable and a modern laboratory provides efficient and agreeable working conditions. Send particulars of qualifications, experience and salary required, to the Personnel Manager, The Plessey Company, Limited, Ilford, Essex. [4059

NATIONAL COLLEGE OF RUBBER TECHNOLOGY, Northern Polytechnic, Holloway, London, N.7.
SENIOR laboratory technician with knowledge of electrical circuits and some experience with electronics required for duties mainly in Physics Laboratory. Department contains X-ray diffraction equipment, radio frequency dielectric heating apparatus and electron microscope. Salary scale £401×£25—£503 with possibility of proceeding to maximum of £580.
APPLY in writing giving full details of age, qualifications, experience, etc., to the Secretary. [4040

SERVICE engineers; all-round experienced and improvers required.—Radio Centre, 33, Tottenham Court Rd., London, W.1. [4022

APPLICATIONS are invited for trainees as studio installation and maintenance engineers for home and overseas service with well-known television company.—Apply Box 0483.

TELEVISION Service Engineers required for inside and outside servicing for Central Scotland, must be fully experienced; first-class wages.—Box 0686. [3979

TESTERS required for television and radio manufacturers; good rates for experienced men, N.W. London area.—Write for full particulars to Box 7628. [0032

EXPERIENCED TV engineers reqd.; must drive; progressive posts and excellent salaries.—Apply Ernest Coyne, 120/122, Ladbroke Grove, W.10. Bay. 1947. [C4015

SERVICE engineers with knowledge of tape recorders required; permanent position; excellent salary.—Radio Centre, 33, Tottenham Court Rd., London, W.1. [4021

AN expanding instrument firm pioneering new developments in the field of radiation physics has vacancies on its research staff for Electronic Engineers or Physicists with an electronic background.
APPLICANTS should have a sound theoretical training and considerable practical experience. The posts would be of particular interest to those who wish to obtain experience in new fields of electronic technology.
THE laboratory is pleasantly situated in Surrey and a Pension Scheme exists.—Box 0635. [5969

TECHNICAL salesman required for West End showroom, specialising in HiFi and tape recorders; knowledge of domestic radio and television also required.—Radio Centre, 33, Tottenham Court Rd., London, W.1. [4020

ENGINEERS required for installation and operation of television transmission equipment.—Apply in first instance by letter, to Engineer-in-Charge, Pye, Ltd., 11, Hinde St., London, W.1. [5865

BUYER required for radio manufacturer situated in West Midlands; experience at senior level in similar capacity essential; four figure salary.—Apply, giving full details of past experience and stating salary required, to Box 0894. [4041

TECHNICAL Engineer required by radio and television component manufacturers in Reading area; £750 per annum.—Apply Gillone Electric, Ltd., Rockstone Works, Rosemary Lane, Blackwater, near Camberley, Surrey. Tel. Camberley 2360. [4055

McMICHAEL RADIO, Ltd., Slough, Bucks, have vacancies from time to time for electronic engineers to be engaged on Government projects; those wishing to be considered are invited to write fully to the Chief Engineer, Equipment Division. [0196

EXPERIENCED radio testers and inspectors required for production of communication and radio apparatus also instrument makers, wirers and assemblers, for factory test apparatus.—Apply Personnel Manager, E. K. Cole, Ltd., Ekco Works, Malmesbury, Wilts. [0236

ELECTRONIC Development Engineers, Senior and Junior, with a leaning towards technical writing, to undertake the preparation of instruction manuals, specifications, etc., for guided weapons and like projects. A working knowledge of pulse circuitry and microwave techniques essential.
APPLY, giving full details of experience, age, etc., to the Personnel Manager, The General Electric Co., Ltd., Brown's Lane, Allesley, Coventry. [3675

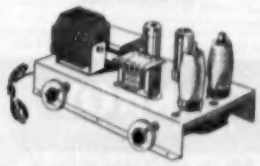
MONEY BACK GUARANTEE **DUKE & CO**
621 ROMFORD ROAD, LONDON, E.12
C.W.O. or C.O.D. • TEL: GRA 6677

T.V. TUBES £5—12"

3 MONTHS' GUARANTEE. (On emission). Not Ex-W.D. Had some hours' use. Various types and makes. Picture shown to callers. Carriage and insurance 15/6 extra. Please quote make and type required when ordering. C.W.O.

T.V. 12in. CHASSIS—97/6.
Complete chassis by famous manufacturer, easily adapted to Channel 3. R.F. E.H.T. unit included. Drawing FREE. Easily fitted to Table or Consul model. Owing to this chassis being in three separate units (Power—Sound and Vision—Timbebase inter-connected) THIS CHASSIS IS LESS VALVES AND TUBE, but see our catalogue for cheap valves. Our £5 Tube fits this Chassis. List of valves by request. Carr. 5/-.

AMPLIFIERS



Push-Pull, **77/6**. 7 watts output A.C. or Universal. 4 valves and 1 rec. Ideal for Pick-up or Mike. Post 2/6, ready to plug in.

AMPLIFIERS. 57/6. 4 watts output, 3 valves. A.C. or A.C./D.C. Ideal for Pick-up or Mike. Post 2/6, ready to plug in.

SPOTLIGHTS. 8/9. Butlers, new but ex-W.D. 7¼in. dia. 6¼in. deep. These lights are similar to those sold for £3-£5, but finished black. This light is easily fitted to dumb irons of bumper. Bulbs now available 6 v. 36 or 48 watt. 12 v. 30 or 48 watt. 4/6 each.

CAR RADIO TRANSFORMERS. 5/9. 6 volt. New. Post 1/-.

LADIES ONLY! Treat the lady and yourself to a heated blanket for the home. **37/6** brings a complete heater kit that a lady can fit by herself *unaided*—with free drawings.

FIRESIDE "RIPPINGILLS" HEATER. 77/6. For the home, works or office. Although these are used ex-W.D. they have all been overhauled and work perfectly (paraffin). Carriage 2/6.

EXTENSION SPEAKERS

Brand new P.M. speaker (low impedance). Mtd. on polished and veneered baffle stand. 9ft. lead ready connected. **ONLY 19/9.** Post 1/9.

H.T. BATTERIES. 3/9. 60 volt, 60 + 1½ volt (personal portable type), 67½ volt (layer type), all Ex-W.D. but fully tested O.K., post 1/-. 87 + 64½ + 4½ Ex-W.D., only 3/9. Post 1/9.

RECTIFIERS 8/9. T.V. Type. Salvage, guaranteed, 250 volts at 200 mA. Post 1/-.

BEDSIDE T.R.F. RADIOS. 4 valve L. & M. wavebands. Walnut, White or Pale Green Plastic Cabinets. Complete **£4/9/6**, plus 3/6 p. & p.

Send 2½d. for catalogue.

Solder with LITESOL

THE LIGHTWEIGHT CHAMPION

NO TRANSFORMER NECESSARY. FOR MAINS OR LOW VOLTAGES.

Rapid Heating—Extreme Lightness—Eight different models—Bit sizes, ⅛", 3/16", ¼", ⅜"—Prices from 19/6.

A precision instrument for discerning craftsmen.

Details of full range in folder No. 5.5 sent on request.

Sole Manufacturers and Distributors:

LIGHT SOLDERING DEVELOPMENTS LTD.,
106, GEORGE STREET, CROYDON, SURREY.
Tel. CROydon 2582.

'TANNOY'
SOUND EQUIPMENT

Tells you what's going on clearly

WEST NORWOOD · S.E.27
Telephone: GIPsy Hill 1131 (7 lines)

TAPE RECORDERS ONLY

Consult
The Northern Specialists
for your
GRUNDIG, PRIMA, WYNDSOR, PLAYTIME & STENORETTE,
etc., etc.
Advice & Repairs.

DIXON'S ELECTRONIC SALES & SERVICE
229 OXFORD RD., MANCHESTER 13
(Nr. University). Telephone: ARD. 4269

TAPE PRE-AMPLIFIER TYPE 4/WRB/2

is of new design, and has been developed specifically for the user with professional requirements, to go with a 3-HEAD TAPE DECK. Comprises separate recording and replay channels with correct equalization characteristics for 7½ and 3¾ i.p.s. tape, peak-programme-type meter and circuit, bias and erase supply, DIRECT/REPLAY monitor comparison switching, cathode-follower output to monitor amplifier. Designed primarily for the WEARITE TYPE 2B TAPE DECK, but suitable for any other good 3-head deck. Deliveries commencing middle January. *Please write for full specification, which will be sent as soon as released.*

ARIEL SOUND
57, LANCASTER MEWS, LONDON, W.2
Telephone: PADdington 5092

SITUATIONS VACANT

TELEVISION Demonstrations.—Applications are invited for the following appointments: (a) SENIOR Maintenance Technicians.—Applicants must have experience of television equipments and be capable of accepting technical responsibility for the efficient maintenance of a studio. (b) CAMERA Control Technician/Operators.—Previous experience of TV cameras and associated equipment an advantage. (c) TELECINE Technician/Operators.—Previous experience of film projection an advantage but applicants must also have a good technical experience to enable them to maintain this type of equipment. (d) SOUND Technician/Operators.—Previous experience of audio amplifiers, microphones, etc., for stage or public address work an advantage. THESE posts are suitable for applicants possessing a good technical background and who are prepared to accept considerable responsibility. All appointments are permanent and pensionable; successful applicants will normally be based in London but may be required to travel overseas; please write, giving full details of experience and qualifications to—Box 0775. [3999

AN expansion of the English Electric Co.'s Guided Weapons Division at Luton has created further vacancies for all grades of Senior and Junior Staff for the Electronics Department, particularly the following:—SENIOR Engineer with experience of production engineering of prototype electronic equipment coupled with a working knowledge of electronic circuitry. SENIOR Engineer to lead a large group of engineers and junior engineers in the development of specialised electronic test gear for factory and field use. SENIOR Engineer with sound fundamental knowledge of electronics coupled with an ability to apply it to general circuit development. SENIOR Instrumentation Engineers with either a degree or H.N.C., together with experience of the design of transducers for use with electronic or bridge measuring systems. SENIOR Engineer to lead a small group concerned with the development and field trials of ground radar equipment. Applicants should have had considerable previous experience of similar work. SENIOR Engineer for Radar experiments and maintenance. Applicants should have a wide experience of Services radar equipments. SENIOR Engineer for missile telemetry installation planning. Applicants must be familiar with existing telemetry systems and measuring techniques. Although no trials work is involved this post would suit a man with trials experience. JUNIOR Engineers and Laboratory Assistants are also required to assist in the above work. HOUSING assistance will be given in some cases. ALL of the above posts are permanent and progressive and attractive salaries are offered to the successful applicants. A STAFF Pension Scheme is in operation.—Applications to Dept. C.P.S., 356-7, Strand, W.C.2, quoting R.E. [4012

APPLICATIONS are invited for posts in a development laboratory located in Northamptonshire; minimum qualification required is a degree in physics or the equivalent; experience in microwave work would be advantageous.—Box 0942. [4014

SCANNER mechanics wanted, must be able to dismantle and repair mechanical details of radar gear, ex-service radar mechanical tradesmen with suitable experience will be considered.—Write, stating experience and wages required, to Box 0738. [3986

TECHNICAL Assistants. A small number of opportunities exist to enter the factory laboratory of a leading radio and television receiver manufacturer for young men of H.N.C. and O.N.C. standards. These positions provide interesting work in the pre-production stages of large scale manufacture. COMMENCING salaries will be in accordance with age, experience and qualifications.—Please apply in writing to the Personnel Officer, Mitcham Works, Ltd, New Road, Mitcham Junction, Surrey, quoting reference G.1. [4043

EXPERIENCED technical executive required by successful public television and radio company to supervise national organization for development, manufacture and service; opportunity of directorship for right man; pension.—Full details in strict confidence to Box 0140. [3525

EXPERIENCED Fault-Finders wanted by Midland manufacturers of radio equipment; permanent post located in the Midlands are offered to men with experience of radar, radio control, V.H.F. equipment.—Write, stating fully experience and salary required, to the Personnel Manager, Box 0564. [3875

SENIOR transformer designer required with experience of all types of transformers up to 3,000 kVA; excellent prospects for an energetic man capable of supervising junior engineers, excellent working conditions, pension scheme, canteen, etc.; West London area.—Applications to Box 8135. [3565

ENGINEER, aged 25 to 35, preferably having a Higher National Certificate required for the maintenance of electronic equipment and the testing and alignment of new instruments used for quality control and automatic testing of all types of telecommunication cables.—Apply, giving full particulars, to Box 8632. [3769

WAFER SWITCHES TO SPECIFICATION

One or more type "H" switches having any desired contact arrangement or wafer spacing made from parts supplied by A.B. Metal Products Ltd.

Most types despatched within 48 hours

Send for Price List of 82 "standard" arrangements and switch design chart

Orders and enquiries by post only:

SPECIALIST SWITCHES
24 CRANBOURN STREET, LONDON, W.C.2

Chassis, Cases and all metal fittings made to specification for the Radio and Electronic Industry.

STAR METAL PLATE WORKS
74, CHURCH Rd., BARNES, S.W.13
Tel.: RIV 6672/3

METER REPAIR SERVICE

ALL TYPES and MAKES
Single and Multi-Range

Phone for immediate service

THE ELECTRICAL INSTRUMENT REPAIR SERVICE
329 Kilburn Lane, London, W.9
Tel.: LADbroke 4168

Kit of parts for the simple construction of a first class Tape Deck

Comprising complete set of accurately machined components with every nut and bolt and full instructions for building a high-quality 2-speed Tape Deck. Very compact, 11in. x 7½in., taking 600ft. reels. Twin track recording with the very latest type High Fidelity Ferroxcube heads (30—12,000 C/S at 7½in.). High-speed capstan, precision balanced flywheel, ball bearing pressure roller giving remarkable freedom from "wow." Fitted with the latest Collaro constant speed motor.

Price £7 10 0

E. W. A.
266, WARBRECK DRIVE, BLACKPOOL

Fidelia

HAND BUILT QUALITY UNITS

MAJOR 10 VALVE RADIOGRAM CHASSIS £32/6/4.

Sandy Sam the golfer man who really looked the part, came into us one day and this is how did start. "From Coast to Coast they all do say that for sound superb Fidelia's the way."
Say's he these days my Bogie's cash but I must now admit. For value find and service too Fidelia really is the firm.

Fidelia F.M. tuner	£13 10 0
Fidelia Standard 7-valve model	£21 12 0
Fidelia De Luxe 9-valve model with 7-watt push-pull triode output stage	£25 5 0
Fidelia 10-watt amplifier	£27 10 0

Full details on request. *ALL MODELS have triode output stages, Variable Selectivity, Separate Bass and Treble Controls, Cathode follower detector. 20-20,000 cycle audio response.*

ELECTRO Acoustic DEVELOPMENTS

3 AMHURST ROAD TELSCOMBE CLIFFS, Nr. Brighton, SUSSEX

Tel: Peacehaven 3156

"AUTOMAT" HOME CHARGERS AND KITS

SELENIUM L.T. RECTIFIERS.

S.T.C., Westalite, G.E.C., etc., 40 m.a. to 10 amps

All new goods with full guarantee.

POULTRY CHARGER KITS. Genuinely trouble free and ultra reliable. As sold for 11 years through "W.W." with full data sheet and instructions. **No. 1 Kit.** (As illus.). Westalite 3 amp. rectifier, 65 watt tapped, impregnated trans., ballast bulb, for 2 v. 6 v., 12 v. charger, all rectifier troubles eliminated, **46/-**, P.P. 1/10. Handsome steel case, ready punched, louvred, enamelled, **12/6**. **No. 1A Kit.** 3 a. rectifier, 65 watt trans., ballast, rns., ammeter for 2 v., 6 v., 12 v. 3 a., **52/6**, p.p. 1/10.

No. 2 Kit. 12 v. 2 amp. rect., 45 watt trans., ballast/indicator bulb for 2 v., 6 v., 12 v. charger, **36/6**. Case **12/6**, p.p. 1/10. Wt. 8lb. with case. **Minor Kit** 6 v. 2 amp., **32/-**, p.p. 1/10, case **12/6** extra. **Senior Model**, for 6 v./12 v. at 4 to 5 amp., 12 v. 5 amp. S.T.C. rect., 65 watt trans., ballast bulb, **64/-**, p.p. 2/-. **Slider Kit**, 120 watts trans., 14 v. 6 amp., large finned type rect., slider rns., high grade ammeter, wt. 17lb., for 6 v./12 v. charger, **84/13/-**, carr. 4/-. Ditto, 3 a. to 4 a., **67/-**, p.p. 2/4.

"AUTOMAT" SELF REGULATING CHARGERS. "Export" model for 6 v./12 v. 5 amps, using S.T.C. selenium rectifier, damp-proof, ultra reliable, wt. 16lb., for 215/240 v. A.C., **86/5/-**, carr. 4/6 extra. Gtd. 12 months. Also our well known 12 v. 3 amp. charger with protective ballast and glow indicator, **69/6**, ditto 6 v., 3 amp./12 v. 2 amp., **69/6**, ditto, 6 v./12 v. 2 a., **59/6**, postage 1/10, wt. 8lb.

SELENIUM RECTIFIERS, new stock not surplus with full data sheet, 6 v. 1 a., **4/-**, 2 a., **7/6**, 4 a., **15/-**, 12 v. 0.5 a., **5/-** 1 a., **7/6** 2 a., **9/6** all p.p. 6d., 12 v./14 v. 3 a. to 3.4 a., **15/6** 5 a., **27/-**. Large finned 5 a., **32/-**, p.p. 10d. 24 v. 50 mA., **2/9**. 24 v. 0.5 a., **9/-**, 1.5 a., **15/-**, 3 a., **27/-**, 5 a., **42/-**, 8 a., **62/-**, all p.p. 10d. 30 v. 1 a., **24/-**, 2 a., **47/-**, 230 v. 1 a., **27/-**, p.p. 1/6. H.T. rectifiers, 120 v. 50 mA. R.M.2, **5/6**, 135 v. 30 mA. elim., **5/6**, 250 v. 60 mA., **7/-**, 250 v. 100 mA. bridge, **14/6**, all p.p. 6d. Many other L.T. and H.T. types in stock.

"RENEWBAT" BATTERY DESULPHATER AND CONDITIONER. Car size, **3/6**, p.p. 6d.

CHAMPION PRODUCTS

43 Uplands Way, LONDON, N.21. Phone LAB. 4457.

SITUATIONS VACANT

TRANSFORMER Designer required for development projects involving audio-frequency power transformers, pulse transformers, oil-filled units, etc.—Apply stating age, qualifications and experience, to The Personnel Manager (Ref. R.G.), The General Electric Co., Ltd., Brown's Lane, Allesley, Coventry. [3260

ELECTRONIC Engineer required by company in East Anglia to take charge of small but expanding department wiring and testing electronic units for precision instruments; practical production experience essential; pension scheme.—Details of age, experience and salary required to Box 0684. [3976

JUNIOR designers required to deal with small transformers power, audio, pulse, etc.; specialised training will be given to engineers with suitable basic training and experience.—Applications to Technical Director, Oresham Transformers, Ltd., Twickenham Rd., Hanworth, Middx. [3569

TECHNICAL Corespondence Clerk. A vacancy exists for a radio and television correspondence clerk at the new factory of Bush Radio, Ltd., Kew.—Applications should be forwarded with full details of past experience, etc., to the Personnel Manager, Bush Radio, Ltd., Power Rd., Chiswick, W.4. [3965

RADIO and radar testers. First-class men required for work on V.H.F. communication gear and Government contracts for radio and radar equipment, by Midland manufacturers; men with wide experience of fault finding in any of the fields mentioned should write, giving full details, to Box 0393. [3874

DECCA RADAR, Ltd., require testers for fault finding and alignment on radar equipment; applicants with experience in radio or television testing considered; good prospects in an expanding department for suitable applicants.—Personnel Officer, Decca Radar, Ltd., 2, Tolworth Rise, Surbiton, Surrey. [4017

ENGINEER with sound basic knowledge of light electrical and A.F. engineering for sound recording equipment department; pension scheme.—Apply, stating experience, qualifications, age and salary required, to the Personnel Manager, B.A.F., Ltd., Woodger Rd., London, W.12. [4010

ELECTRONIC Engineers.—If you are seeking a permanent position in a Company specialising in control equipment for the industrial field, your attention is drawn to the fact that Messrs. Lancashire Dynamo Electronic Products, Ltd., have, as a result of further expansion, a number of vacancies for technical and administrative staff.

THE vacancies are as follows:—

A. Application Engineers with electrical engineering background and some knowledge of industrial electronic equipment, capable of discussing and interpreting the requirements of the customer and formulating complete schemes involving electrical machines, contactor gear and electronic equipment. Applicants must be capable of preparing specifications and conducting correspondence with the customer in relation to such projects.

B. Technical Writers capable of preparing catalogue information and producing complete instruction manuals from basic circuit details.

C. Design Engineers with electronic and/or electrical engineering background, capable of interpreting equipment specifications in terms of existing circuit techniques, and passing detailed circuit information to the Drawing Office, specifying component requirements, supervising mechanical design and preparing test specifications.

D. Draughtsmen capable of undertaking from design information the mechanical design and layout of electronic equipment in consultation with Design Engineers.

E. Development Engineers for Laboratory to work on solution of specific industrial problems and in the development of new circuit techniques. Background on electronic circuit techniques and/or servo design essential.

A superannuation scheme applies to all the positions advertised. Applicants should write in the first instance, indicating experience and salary required, to LANCASHIRE Dynamo Electronic Products Ltd., Rugeley, Staffs., marking the envelope "TAB Application" and should indicate the position in which they are interested by means of the reference letters. [4034

TEST gear design engineers and maintenance engineers required with practical experience of this class of work based on sound knowledge of electronic principles; these vacancies are permanent and progressive; a company pension scheme in operation; London area.—Please write, in confidence, giving full details of qualifications, to Box 0811. [4006

RADIO testers required, some v.h.f. experience desirable together with some servicing knowledge on domestic or service equipment.—Applications, giving full details of previous experience and qualifications, should be submitted in writing to The Personnel Manager, Pye Telecommunications, Ltd., Newmarket Rd., Cambridge. [3806

A FULLY qualified Television Engineer required for a modern maintenance dept. Excellent wages plus generous weekly bonus, pension fund, sick pay, etc.—Apply immediately in writing stating age, experience and qualifications to the Personnel Manager, Co-operative Society, 110, Fratton Rd., Portsmouth. Endorse envelopes "Television Engineer." [3975

GALPIN'S

ELECTRICAL STORES

408, HIGH STREET, LEWISHAM, S.E.13

Tel.: Lee Green 0309. Nr. Lewisham Hospital

TERMS: CASH WITH ORDER. NO C.O.D.

All goods sent on 7 days' approval against cash.

EARLY CLOSING DAY THURSDAY.

HEAVY DUTY SPOT WELDER TRANSFORMERS, input 200/250 volts. OUTPUT a combination of 2, 4, 6, 8, 10, 12 volts at 120/150 amps. New £6/15/- each, carriage 6/-.

LIGHT ARC WELDING TRANSFORMERS, 200/250 volts input output 40/60 volts, 30/40 amps, £7/5/- each.

MEDIUM SPOT WELDING TRANSFORMERS, input 200/250 volts, OUTPUT a combination of 2, 4, 6, 8, 10, 12 volts at 50/70 amps. New £5/2/6, C/paid.

HEAVY DUTY L.T. OUTPUT TRANSFORMERS 200/250 volts input, output a combination of 6, 12, 18 and 24 volts at 30 amps. £4/2/6 each. C/paid.

Another input as above, output 0, 6, 12, 18, 24 volts at 12 amps, 55/- each, post 2/-. Another input as above, output 0, 6, 12, 18, 24 volts, 6/8 amps., 46/6 each.

HEAVY DUTY L.T. TRANSFORMERS suitable for rectifiers, soil heating, etc. Input 200/250 volts. Output a combination of 6, 12, 18, 24 30, 36 volts at 15 amps., 67/6 each, post 2/6. Another input and output as above but at 6 amps. 47/6, post 2/-. Another input and output as above but at 4 amps. 36/6 ech.

CONVERTORS, 400 watts output, 24 volts D.C. input 50 volts 50 cycles 1 phase output. Complete with step up transformer from 50 volts to 230 volts at 400 watts £12/10/- each C/F. Ditto 200 watts £9/10/-each C/F., fully guaranteed.

ROTARY CONVERTORS. 230 volts D.C. input 230 volts A.C. ouput. 50 cycles 1 phase at 250 watts. £15 each C.F.

EX-RADAR MAINS TRANSFORMERS. Input 230 volts. Output 4 or 5 Kilo volts at 30 min., also 3 L.T. windings 4, v. 2 a., 6.3 v. 2 a., 2 v. 2 a., these transformers are capable of a larger output than stated and are immersed in oil. £3/15/- each, carriage 5/-.

MAINS TRANSFORMERS (NEW), input 200/250 volts in steps of 10 volts, output 350/0/350 volts, 180 m/amps., 4 volts 4 amps. 5 volts 3 amps. 6.3 volts 4 amps. 45/- each, post 1/6; another 350/0/350 volts 180 m/amps., 6.3 volts 8 amps, 0-4/5 volts 4 amps., 45/- each, post 1/6; another 500/0/500 volts 150 amps., 4 volts 4 amps., C.T., 6.3 volts 4 amps., C.T., 5 volts 3 amps., 47/6 each, post 1/6; another 425/0/425 volts 160 m/amps., 6.3 volts 4 amps., C.T., twice 5 volts 3 amps., 47/6 each, post 1/6.

MAINS TRANSFORMERS, 200-250 volts input, output 400/0/400 volts, 280 m/amps., 6.3 v. 8 a., 2 v. 3 a., 5 v. 3 a., 4 v. 2 a., 4 v. 2 a., the last two heaters insulated at 8,000 volts. 85/- each another 200/230 volts input, output tapped 0, 9, 18 volts at 4 amps., 25/- each, post 1/-.

EX-U.S.A. ROTARY CONVERTORS, 12 volts D.C. input, outputs 500 volts 50 mA. 275 v. 100 mA. Complete with smoothing 22/6 each, carriage 2/6. As new.

EX-NAVAL ROTARY CONVERTORS, 110 v. D.C. input 230 volts A.C. 50 cy., 1 ph. 250 watts, output. Weight approx. 100 lb. £12/10/-, C/F.

ELECTRIC LIGHT CHECK METERS, useful for subletting, garages, etc., all for 200/250 volts A.C. mains, 5 amp. load, 19/- each; 10 amps., 22/6; 20 amps., 27/-; 25 amps., 32/6.

1,000 WATT AUTO WOUND VOLTAGE CHANGER TRANSFORMER tapped 0/110/200/230/250 volts. £5/15/- each, carriage 4/6. 1,500 watt ditto, £7/15/-, carriage 7/6.

350 watt 55/-, 500 watt 75/-, 200 watt 45/-.

MOVING COIL SWITCHBOARD VOLTMETERS 6in. scale 0 to 75 volts 30/- each; ditto 0 to 200 volts 35/- each; ditto 0 to 40 volts 27/6 each.

CHARGING KITS CONSISTING OF RECTIFIER AND TRANSFORMER for charging 6 or 12 volt batteries at 2 amps. (input 200/250 volts) 32/6 each; ditto for 4 amps., 46/6 each.

EX-R.A.F. DYNAMOTORS 24/28 volts D.C. input 1,200 volts, 17 milliamps ½ hour rating, 11/6 each.

EX-RADAR IMPULSE TRANSFORMERS 2 Mu-Metal transformer in oil, Output believed to be 15 k.v. at 3 kW. R.F., only 7/6 each.

ROTARY CONVERTORS 24 volts D.C., input 50 or 110 volts 500 cycles 1 phase, Output at 300 watts, £7/10/- each C/forward.

D.C. MOTORS 230 volts 0.3 h.p., large 7 000 r.p.m. long shaft, £3/5/- each.

Clients in Eire, please allow at least double the carriage stated to allow for Customs clearance charges.

NEW BOOKS ON RADIO & TELEVISION

Modern Oscilloscopes and their Uses by J. H. Reiter	40/-
Practical T.V. Aerial Manual for Bands I and 3, by R. Laidlaw	4/9
Radio and T.V. Engineers' Reference Book, by Molloy	72/-
Radio Designers' Handbook, by Langford Smith	42/6
Transistors and Crystal Diodes, by S. R. Bettridge	5/3
Sound Reproduction, by G. A. Briggs	10/6
T.V. Fault Finding, by "Radio Constructor"	5/3
Loudspeakers, by G. A. Briggs	8/-
The Oscilloscope at Work, by A. Haas and R. W. Hallows	15/6
New Osram 912 Amplifier	3/9
New Mullard 10 watt Amplifier	2/9

ALL POST FREE. Write for New List of ENGLISH AND AMERICAN BOOKS AND PERIODICALS

UNIVERSAL BOOK CO.

12 LITTLE NEWPORT STREET, LONDON, W.C.2. (Adjoining Lisle St.)

ARKAY KITS WORLD'S FINEST

RADIOS PHONOGRAPHS TV TEST EQUIPMENT HI-FI

Write for FREE Brochure

Radio Kits, Inc. • 120 CEDAR STREET

NEW YORK 6, NEW YORK • U.S.A.

CABLE

CHEAPER IN SMALL COILS

No coil under 25 yds. unless requested. All prices per a 100-yd. lot. Less supplied, add 5%.

	1/044	2/029	W/E	W/E
Twin Flat				
Rubber	43/-	55/-	69/-	109/-
Plastic	33/-	36/-	41/-	107/-
Single V.I.R.	18/-	23/-	—	30/-

EARTH WIRE 7/029 tinned copper, 8/6 a 100-ft. lot. Send for lists of other cables, flexes, wiring accessories, ex-surplus switch and fuse gear. (We buy surplus electrical items, send details.) Add part carriage to small orders please.

BRITISH DISTRIBUTING (Desk W), 621 Green Lanes, London, N.13.

Purchase or hire your 'VORTEXION TAPE RECORDER' & ASSOC. EQUIPMENT FROM GRIFFITHS HANSEN (Recordings) LTD. 32/33 GOSFIELD ST., LONDON, W.1. MUSeum 0642/2771.

TELECRAFT

TV AERIALS

ARE CHEAPER AND BETTER

Send for Lists

TELECRAFT LTD.

Quadrant Works, Wortley Rd. West Croydon, Surrey. THOrnton Heath 1191-2-3

THE POLLOCK M.C. PICKUP

Response 10 c.s. to 20 Kc/s. H.F. resonance 25 Kc/s., L.P. 20 Kc/s. Kit of parts to make pick-up complete, including 100 : 1 transformer and sapphire stylus, .001 or .0025in., and full building instructions £4. 8s. 6d. Parts sold separately, prices: head and stylus 38/6; head for min. thorns 31/-; arm/pivot 26/-; transformer 26/-; all prices post free. S.a.e. for details to—

G. BLUNDELL, 7 Sunnyside House, Child's Hill, London, N.W.2.

SITUATIONS VACANT

RADIO and/or television engineer required for bench and outside repairs, driver; references, age, experience, salary expected.—Field's Radio, Ltd., 52, Hall Gate, Doncaster. [5542

RADIO service mechanics required by Smiths (Radiomobile), Ltd., for many parts of the country.—Write details of experience and qualifications to Personnel Officer, Goodwood Works, North Circular Rd., London, N.W.2. [0542

PHYSICIST.—Young graduate required for research and development work on transistors and their applications; excellent opportunities and wide scope for man with initiative.—Applications, giving age, full details of qualifications, experience and salary required, should be forwarded to Personnel Dept., Murphy Radio, Ltd., Welwyn Garden City. [5990

ELECTRONIC engineer required to supervise testing of prototype electronic equipment, an ability to quickly diagnose faults, and a wide experience of modern test equipment are essential qualifications; this is a staff position offering good prospects to the right applicant. APPLY: The Wayne Kerr Engineering Co. Ltd., Tolworth Close, Surbiton, Surrey. [5992

TELEVISION service engineer required by leading dealer holding all main agencies; good position for first-class engineer with high standard of service; semi-detached modern house with garage available if required and good rate of salary.—Write, stating details of experience, etc., A. E. Hughes & Sons, 26, Clarence Place, Newport, Mon. [5881

ELECTRONIC Engineer with practical experience in industrial applications and good technical knowledge is required by a large food organisation centred in London, for the development, design and construction of electronic equipment. Applicants should have initiative and be resourceful. Post will be of supervisory grade and salary according to age and experience.—Apply Box 0695. [5978

WANTED, deputy chief inspector to cover both mechanical and electrical inspection and test of electronic equipment, under A.I.D. conditions; successful applicant will be required to serve a probationary period as quality inspector, 5-day week, excellent canteen facilities.—Applications, stating salary required, to Personnel Manager, E.M.I. Factories, Ltd., Treorchy, Rhondda, S. Wales. [5885

BRITISH ACOUSTIC FILMS, Ltd., Woodger Rd., W.12, have vacancies for laboratory engineers and scientists to work on sound recording and reproducing equipment and kindred projects for television, 35 and 16mm film, tape recorders, etc.; salary according to experience and qualifications; pension scheme.—Application should be made, in writing, to the Personnel Manager. [4019

E. K. COLE, Ltd., Malmesbury Division, require Draughtsmen for interesting work on radar and communications projects, minimum qualification O.N.C., knowledge of ministry design requirements to R.C.S. 1000 an advantage. Salary dependent upon ability, experience and qualification. Apply to Personnel Manager, Elco Works, Malmesbury, Wiltshire. [4042

RADIO and TV engineer with laboratory experience required by leading London firm of electrical component manufacturers for work in connection with printed circuits; H.N.C. standard; superannuation scheme.—Write, giving full details of education and experience, age and salary required, to Personnel Manager, Box 534 L9248, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2. [5849

TEST department personnel required for expanding department engaged in the production of small and varied batches of electronic and nucleonic equipment; highly interesting work with opportunities of gaining experience of the latest developments in electronic applications.—Write, stating age, experience, and salary required, to Personnel Manager, E. K. Cole, Ltd., Southend-on-Sea. [5967

ELECTRONIC Engineers required: excellent opportunity for men of degree standard to broaden experience in a field of great interest and variety involving latest techniques; restrictive specialization can be avoided by joining Marconi Instruments who produce light current communication, measuring, and test apparatus for a wide range of requirements.—Apply Marconi Instruments, Ltd., Longacres, Hatfield Rd., St. Albans. [5895

MECHANICAL engineer reqd. for work on the design of small electro-mechanical equipments; applicants should have served an engineering apprenticeship, or the equivalent, together with several years' experience in the field of design; small model shop facilities available to engineer; Greenford area; pensionable and salary commensurate with ability.—Apply giving age and fullest details of experience to Box 0678. [4026

RADIO technicians required by International Aeradio, Ltd., for overseas service; permanent and pensionable positions, inclusive salary from £894 per annum to £1,373 per annum, tax free, according to marital status; free accommodation; kit allowance; free air fares; generous U.K. leave.—Qualified candidates to whom replies only will be sent please write quoting RT to Personnel Officer, 40, Park St., W.1. [0262

The MINNETTE 46 Gns. with mic and tape (carr. 7/6)

Specification includes 2 speeds 2 tracks, press-button control, 5 v. plus magic eye, 'phone monitoring, remote stop-start.

Model 44, ten watt replay, price 60 gns. Hi-fi eight valves with Truvox deck.

Write for fully descriptive literature and H.P. Terms from £5 deposit.

NOTE: MODERN RECORDERS are in short supply. We ask your indulgence if you cannot obtain "on the dot"—more and more people are asking for them—place your order early, either direct or with your local dealer.

MODERN SOUND EQUIPMENTS

16 Pattison Road, London, S.E.18

WOO 0387

PRECISION SHEET METALWORK

We specialise in manufacturing of Chassis in all metals, large or small quantities to your own specifications.

V. W. BEAMISH

Shardeloes Garage, Shardeloes Rd., New Cross, London, S.E.14.

Telephone: TIDeway 4795

THE **CHAFFEY CABINET COMPANY**

63a, CHELTENHAM RD., LONDON, S.E.15

TEL: NEW CROSS 4766

BATTERY CHARGERS for the Motorist

EASCO ELECTRICAL (Sales) LTD

BRIGHTON TERRACE, LONDON, S.W.9

'Phone BRixton 4961 (3 lines)

ROTARY CONVERTORS

Type 22 (10K/17). Input 12 v. Output 1200 v. 200 m/a.
Type 23 (10K/18). Input 24 v. Output 1230 v. 200 m/a.
Type 24 (10K/19). Input 12 v. Output 217 v. 110 m/a. 7 v. 13 m/a.
Type 25 (10K/20). Input 24 v. Output 217 v. 110 m/a. 7 v. 13 m/a.

TESTED, GUARANTEED. 12/6 each plus carriage.

A. J. WHITTEMORE (Aeradio) LTD.

Croydon Airport, Surrey. Tel.: Croydon 6701, 6885, 7741. Grams: Aeradio, Croydon.

AUTOMATIC (TIME) SWITCHES

New and reconditioned 15 day clockwork and electric switches

from **35/-**

Send S.A.E. for illustrated details to:—

DONOHOE (TIMERS) GEORGE STREET NORTH SHIELDS, NORTHUMBERLAND

SOUTHERN RADIO'S WIRELESS BARGAINS

TRANSRECEIVERS. Type "38" Mark II (Walkie-Talkie). With 5 valves and ready for use. Metal carrying case, **30/-** per set.
THROAT MICROPHONES, with long lead and plug, **4/6.**
JUNCTION BOX, 2/6. HEADPHONES 15/6 per pair. **AERIALS, 2/6.** ALL OF THESE ITEMS ARE FOR USE WITH THE "38" Walkie-Talkie.
TRANSRECEIVERS. Type "18" Mark III. Comprising Superhet Receiver and Transmitter. Two units contained in metal carrying case. Complete with 6 valves, **£4/10/-** per complete set.
RECEIVERS. Type "109." Built-in speaker. 8 Valves with VIBRATOR PACK for 6 volts. Contained in metal case. Perfect, **£5** each.
TELESONIC 4-valve Battery Portable. Complete with Hivac valves in metal carrying case. Simply converted to Personal Portable, **£2** per set including Conversion Sheet.
BOMBSIGHT COMPUTERS. BRAND NEW ex-R.A.F. Contains gyro, motors, rev. counters, gear wheels, etc., etc. Ideal for model makers, experimenters, etc., **£3/5/-** each, plus 10/- carr.
LUFBRA HOLE CUTTERS. Adjustable ⅞ to 3¼in. For metal, wood, plastic, etc., **6/6.**
RESISTANCES. 100 Assorted, all useful values, etc. Wire end, **12/6** per 100.
CONDENSERS. 100 Assorted. Mica, Metal, Tub, etc., **15/-** per 100.
PLASTIC CASES. 14in. by 10½in. Transparent. Ideal for maps display, etc., **5/6.**
STAR IDENTIFIERS. Type I A-N. Covers both Hemispheres, in case, **5/6.**
CONTACTOR TIME SWITCHES. In sound-proof case, 2 impulses per second. Thermostatic control. Clockwork movement, **11/6** each.
REMOTE CONTRACTORS for use with above, **7/6** each.
MORSE PRACTICE (WITH BUZZER) SET. Mounted, **6/9.** Full List of Radio Books, **2½d.**
METERS, 12 Instruments. May need adjustment or with broken cases, **35/-** for 12.
Postage and carriage extra.
SOUTHERN RADIO SUPPLY LTD.
11 LITTLE NEWPORT STREET
LONDON, W.C.2 Gerrard 6653

By Order of the Mortgagees
IMPORTANT FREEHOLD PREMISES
known as
GRAND THEATRE FULHAM S.W.6.
Situate in a prominent and accessible position, almost adjacent to Putney Bridge, and occupying a
VALUABLE ISLAND SITE
having an area of about 10,750 sq. ft. with Extensive Frontages to Three Roads, and comprising a
SUBSTANTIAL & IMPOSING BUILDING
with Stage; and Stalls, Dress Circle, Balcony and Gallery.
ACCOMMODATION SUFFICIENT FOR SEATING 830 PERSONS
Suitable for re-use as a Theatre or for Public Entertainment as
RECORDING, FILM OR TELEVISION STUDIO
or with Conversion and/or Development to
SHOWROOMS, OFFICES, WAREHOUSE, ETC.
VACANT POSSESSION
(Subject to and with the benefit of agreements as to advertisement hoardings and newspaper stand.)
To be offered for Sale by Auction at an early date (unless previously sold by Private Treaty) at The London Auction Mart, 155, Queen Victoria Street, E.C.4.
Particulars and Conditions of Sale of
HENRY BUTCHER & CO.
Auctioneers, Surveyors and Valuers,
73, Chancery Lane, London, W.C.2.
HOLborn 8411
Solicitors: Messrs. HERBERT SMITH & CO., 62, London Wall, E.C.2.
Tele: NATional 9771.

SITUATIONS VACANT

E.M.I.—Domestic Electronics Division have a vacancy for a T.V. design engineer for an interesting programme in receiver development (including colour receivers). Applicants should have good academic background with at least three years' experience in this field.—Please write with full details to Personnel Dept. (DED/2), E.M.I. Factories, Ltd., Blyth Rd., Hayes, Middx. [4057

SENIOR Electronic Engineers, Mechanical Designers, Draughtsmen and Detail Draughtsmen are required by a leading Midlands manufacturing concern engaged on the design, development and production of domestic radio and television and on Government contract work, an expanding programme will provide excellent opportunities for promotion; applicants should write to—The Personnel Manager (Ref. OLD), Box 0742. [3996

SENIOR and junior development engineers required for responsible work in radio and television development laboratories, applicants for senior positions should be able to undertake development work with minimum supervision; excellent conditions and salary available for applicants who are accepted.—Apply in first case to Personnel Manager (Dept. R.D.), McMichael Radio, Ltd., Wexham Rd., Slough, Bucks. [3880

LIAISON Engineer/Writer reqd. with sound basic knowledge of television and radar principles; he will be reqd. to work with design teams engaged on complex television and radar projects, to assimilate the technical details and subsequently prepare technical notes in good and concise English.—Applicants should write, with full details, to the Personnel Dept. (ED/182), Eng. Dev., Ltd., Hayes, Middx. [3968

ELECTRONIC Wiremen required to assist in the production of Prototype High Grade Television Transmission and similar equipment; applicants to possess fundamental knowledge of radio and television, to be capable of producing own component layouts and wiring to a high standard; pension scheme, canteen.—Write, stating age, experience, and salary required, to Cinema-Television, Ltd., Worsley Bridge Rd., Lower Sydenham, S.E.26. [4046

FIRST-CLASS Man is required for the inspection and test of industrial electronic apparatus. He should preferably have served an apprenticeship in the electrical industry, being in possession of Higher National Certificate and aged 25-35. Good prospects are open to the right man. Write giving full details of age, experience and salary required to Philip's Balham Works, Ltd., 45, Nightingale Lane, Balham, S.W.12. [4044

TEST engineers are required to assist in the production of a variety of precision electronic laboratory instruments; previous test department experience is essential (preferably in connection with measuring instruments); salaries in the range of £450-£575 p.a. according to qualifications and experience.—Apply, stating full details to the Personnel Manager, Furzehill Laboratories, Ltd., Borehamwood, Herts. [3920

MECHANIC required for duties in the Department of physics, good knowledge of electronics essential, with experience in instrument making and repairing; duties will include maintenance and construction of electronic laboratory and experimental apparatus; weekly rate of pay £9/5/2 (44 hours).—Written application should be addressed to the Head of the Department of Physics, Chelsea Polytechnic, Manresa Rd., S.W.3. [3995

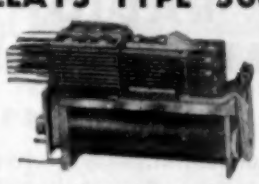
RADIO and TV engineer required by Mains Radio Gramophones, Ltd., to take over position of chief of test; to be responsible for test standards and for technical liaison between development and production; good prospects in expanding organization for right applicant; superannuated staff position.—Please send details of experience and salary expected to the Personnel Manager, 359, Manchester Rd., Bradford. [4005

JUNIOR apparatus technician required to assist in the building of scientific apparatus. Applicants should be working for City and Guilds certificates of the Ordinary National Certificate in electrical or radio engineering. Salary scale £150 (age 16) to £395 a year. Application forms, to be returned within 7 days, from Secretary, Institute of Psychiatry, Maudsley Hospital, Denmark Hill, London, S.E.5. (MRC) [4058

E.M.I.—Domestic Electronics Division have a vacancy for a development engineer in their component laboratory, for work which includes design of high fidelity equipment, loud speakers and pick-ups; applicants should have a good academic training and preferably experience in the design of electro-mechanical components.—Please write with full details to Personnel Dept. (DED/3), E.M.I. Factories, Ltd., Blyth Rd., Hayes, Middx. [4056

ELECTRICAL foreman with wide production experience in radio industry of small and medium electrical control gear manufacture, test and installation required by manufacturers of materials handling vehicles in pleasant country district, 1 hour London; good prospects of advancement; housing assistance; canteen and social facilities.—Please write, giving details of age, past experience, present salary, salary required, married/single, to Box 0809. [4004

RELAYS TYPE 3000



BUILT TO YOUR SPECIFICATION—EARLY DELIVERY—QUOTATION BY RETURN—PLEASE STATE RESISTANCE OF COIL REQUIRED AND CONTACT BUILD U

MICROAMMETERS
250 F.S.D. 3½" FLUSH MODEL 627
Specially scaled for test meters. Knife edge pointers, magnetic shield. Brand new **55/-**

RECEIVER R1155
BRAND NEW, AERIAL TESTED
In maker's original transit case. Now is the chance to get one from the best delivery we have had from the Ministry. Carr. 10/6th. Send S.A.E. for further details or 1/3 for publication giving circuit diagrams, etc. Others available from **£9/10/-** according to condition. **£11-19-6**

45 Mc/s PYE IF STRIP. These vision units are brand new and complete with 6 EF50 valves and EA50. Our price only **65/-.** Post 2/6.

RACKS P.O. STANDARD for 19in. panels. Steel channel sides, correctly drilled. Heavy angle base. Height, 4ft. 10in. or 6ft., or 7ft. 2in.

AIR COMPRESSORS. 60 lb./sq. in. Ex-R.A.F. Size 9in. x 5in. Splined shaft 1¼in. x ½in., **37/6.** Post 2/6.

VACUUM PUMPS or Rotary Blowers. Ex-R.A.F. Brand new, 7 cu. ft. per min. 10 lb. per sq. in. at 1,200 r.p.m. Ideal for a brazing torch, etc. Size 6in. x 4in. shaft 2 x ¾in., **22/6** each. Post 2/-.

AERIAL RODS. 12in. long, ¼in. diameter. Any number of sections can be fitted together, **2/6** dozen. **6/-** for 3 dozen. Post 1/-.

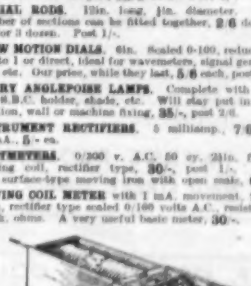
SLOW MOTION DIALS. 6in. Scaled 0-100, reduction 250 to 1 or direct, ideal for wavemeters, signal generators, etc. Our price, while they last, **5/6** each, post 1/-.

TERRY ANGLEPOISE LAMPS. Complete with flex and B.S.C. holder, shade, etc. Will play part in any position, wall or machine fixing, **35/-,** post 2/6.

INSTRUMENT RECTIFIERS. 5 milliamp., **7/6** ea. 50 mA., **5/-** ea.

VOLTMETERS. 0/300 v. A.C. 50 cy., 2½in. flush moving coil, rectifier type, **30/-,** post 1/-. Also 3in. surface-type moving iron with open scale, **60/-.**

MOVING COIL METER with 1 mA. movement, 2½in. flush, rectifier type scaled 0/160 volts A.C., resistance 100 k. ohms. A very useful basic meter, **30/-.**



ELECTRO MAGNETIC COUNTERS. Post Office type 11A, counting up to 9,999. 2 to 6 volts D.C., 3 ohm coil **12/6** each, post 1/-. Many other types in stock, lists sent with order or send S.A.E.

HEADPHONES. HIGH RESISTANCE 4,000 Ω. Type CHE. New. **12/6** pair. Post 1/6.

CONDENSERS. PAPER BLOCK TYPE

.5mfd., 1,000 volt	2/6	8mfd., 500 volt	7/6
4mfd. 350 volt	4/6	8mfd., 750 volt	10/6
4mfd., 2,000 volt	7/6	16mfd., 350 volt	10/6

R.F. UNITS TYPE 26. 50/65 Mc/s. Variable tuning, complete with valves. **35/-.** Post 2/6.

AMPLIFIERS. A high-fidelity unit with separate bass and treble controls, constant impedance attenuator for setting volume level. In metal case with handles. 15 watt output, for 200/250 v. A.C. mains operation. Intended for use with the Gaumont British Projector. Ideal for P.A. work, dances, etc. Less valves, **£12/10/-.** Or complete with all valves, **£15/12/6.** Carr. 10/-.

ROTARY CONVERTERS. Input 12 volts D.C., output 230 volts A.C. 50 cycles, 100 watt, **92/6** each. Also available with 24 volt input, carr. 7/6.

LISTS AVAILABLE. Motors, Meters, Telephones, Rectifiers, Relays, Potentiometers, Resistances. All types including High Stability Carbon and Wirewound. Send S.A.E.

L. WILKINSON
(CROYDON) LTD. DEPT. W.W
19, LANSDOWNE ROAD,
CROYDON

RADIO MECHANICS

wanted for testing communications receivers and transmitters.

•

Apply with full particulars to:—

PYE MARINE LTD.

OULTON WORKS,
LOWESTOFT - SUFFOLK

WEBB'S SERVICE DEPARTMENT

for complete renovation of complex communications receivers of any make

Test report issued showing sensitivity, selectivity, signal/noise equal to, or better than, makers' original figures.

WEBB'S RADIO,
14, SOHO STREET, LONDON, W.1

R.F. OSC. E.H.T. COILS
TYPE 'D' 6-9 K.V. 25/-
TYPE 'F' 9-14 K.V. 30/-
COMPLETE WITH CIRCUIT
TERMS: C.W.O. POST ORDERS ONLY
THE WATSON WATCH Co.
29 Leigh Rd., London, N.5

GRAMOPHONE RECORD CABINETS

£5/10/- to £17. Write for details.

Easy Payments

A. L. Stamford (Dept. H.22),
20, College Parade,
Salusbury Rd., London, N.W.6.

TESTOSCOPE *Mains Tester*

For use on live Voltage testing. — 1/100 each 1000 volts A.C. or D.C. Write for interesting leaflet 20F.
16 page Manual (How to make 50 electrical tests) 1/-

RUNBAKEN · MANCHESTER 1

SITUATIONS VACANT

TELEVISION engineers required by old-established company holding every one of the well-known agencies; applicants must be fully experienced and preferably able to drive; top rates and permanent progressive positions to the right men.—Apply to A. S. White & Sons, Ltd., 130/2, High Rd., S. Tottenham, London, N.15. Sta. 7861-2. [3178

SENIOR coilwinding planning engineer required, experienced in the planning of radio and television coils; the selected candidate will have the drive and initiative necessary to deal rapidly with the day-to-day electrical and mechanical problems on the shop floor, East London area; this vacancy, for which a good salary will be paid, presents ample scope and opportunity to a man of first-class ability.—Please reply, giving full details of experience, to Box 0159. [3987

A VACANCY occurs for a Works Costing Engineer for radio and television production; applicants should have had a good education, preferably with a degree, and should be members of the Institute of Cost and Works Accounting; experience of Budgetry Control, Standard Costing and Estimating is essential; the situation is permanent and offers good prospects to suitable applicant.—Apply in writing to Personnel Department, Murphy Radio, Ltd., Welwyn Garden City. [4051

MARCONI Instruments, Ltd., have an immediate vacancy at St. Albans in their Technical Literature (Telecommunications) Section; the applicants should have electrical engineering qualifications and/or experience in the design or development of electronic equipment; the duties are varied and interesting and the post provides a permanent and pensionable position in a well-established company.—Apply Marconi Instruments, Ltd., Longacres, Hatfield Rd., St. Albans. [3694

DECCA RADAR, Ltd., require technicians and engineers for radar installation at home and abroad; previous industrial and/or service experience essential; ex-technical officers and senior N.C.O.s from H.M. Forces are particularly invited to apply.—Applications should be made in writing in the first instance giving full details of qualifications, past experience, and salary required to the Manager, Heavy Installations Division, Decca Radar, Ltd., Malden Way, New Malden, Surrey. [3696

SENIOR and Junior Design Draughtsmen required for interesting work in connection with electronic equipment, commercial radio and television and/or light electro-mechanical engineering; London area; the positions vacant offer ample scope and opportunity for future advancement to men of good ability; a high salary will be paid to the selected candidates; all recognised staff privileges available.—Please reply, giving full details of experience, to Box 0043. [4015

ELECTRONICS installation and service engineers required for work in field and laboratory; interesting and responsible posts in new expanding department; duties embrace V.H.F., electronic and nucleonic activities in commercial sphere; applicants must have practical technical knowledge and servicing experience, preferably with electronic instruments.—Write, stating age, qualifications and experience, to Personnel Manager, E. K. Cole, Ltd., Southend-on-Sea. [4011

RADIO Repairing Instructor (unestablished) required at Slough Government Training Centre. Applicants must be skilled craftsmen who have completed articles of apprenticeship or a period of training acceptable to the appropriate craft union and have not less than five years' recent practical experience at their trade. Commencing salary £550 per annum plus pay supplement of £25, on a scale of £550×£25 to £640, plus pay supplement. Lower rate if under 28.—Apply to any Employment Exchange. [3981

THE GENERAL ELECTRIC Co., Ltd., Brown's Lane, Allesley, Coventry, requires mechanical development engineers, designer draughtsmen and draughtsmen, preferably with experience of radar-type equipments for work on guided weapons and like projects; also required, senior and junior electronic development engineers, particularly in the field of microwave and pulse applications; salary according to age, qualifications and experience.—Apply by letter, stating age and experience, to the Personnel Manager, Ref. R.G. [0259

DEVELOPMENT engineers are urgently required for work on advanced television and radio receiver circuitry by a progressive company with laboratories situated in Central London, some experience in this field essential. Candidates with H.N.C. or equivalent will get preference, and experience of magnetic tape recorders will be welcomed; attractive salaries are offered in accordance with experience and qualifications.—Reply in confidence to Chief Engineer, Hartley Baird, Ltd., 37-39, Thurloe St., S.W.7. Tel. Knightsbridge 2511. [4047

THE GENERAL POST OFFICE has vacancies for radio operators at its coast radio stations and applications are invited from men between 21 and 35 years of age who hold the Postmaster-General's first-class certificate of proficiency in radiotelegraphy. Selected candidates will be considered later for permanent pensionable posts.—Application should be made to The Inspector of Wireless Telegraphy, Radio and Accommodation Department, Wireless Telegraph Section, Union House, St. Martins le Grand, London, E.C.1. [3606

Electronic computing techniques are now being successfully applied to many accounting and statistical problems. There are excellent prospects with the expanding Production Development and Research Departments of the **British Tabulating Machine Co. Ltd., Letchworth, Herts.,** for University Graduates and men of H.N.C. standard or higher with an interest in electronics and their application to computing machines. The Company will be pleased to hear from men seeking an opening in this field. Assistance with housing may be given to suitable applicants. Pension and Sick Pay Schemes are in operation. Enquiries should be addressed to Personnel Officer in the first instance.

THE 'Dust Bug'
AUTOMATIC GRAMOPHONE RECORD CLEANER
PATENT APPLIED FOR
From **CECIL E. WATTS**
Consultant and Engineer (Sound Recording and Reproduction)
Oakleigh Grange, High Cross, nr. Uckfield, Sussex.
Or your local dealer.
Price 18/6, plus 6/2 purchase tax

Introducing—
THE "ELBAR" TAPE RECORDER
Two speed, twin track, portable, for faithful reproduction of speech and music.
45 guineas complete with microphone.
Write for illustrated leaflet.
JACKSON RADIO
163 Edgware Road, London, W.2 PAD 0537

CABINETS
We specialise in making **HIGH CLASS** cabinets to individual specification, particularly in high fidelity field.
Competitive Prices.
ALAN GRANSTON (*Cabinet Makers*),
29, Lorrimore Bldgs., Olney Road, Walworth,
Phone: RODney 2349. **LONDON, S.E.17.**

RADIO & TELEVISION COMPONENTS
WE OPERATE A PROMPT & EFFICIENT MAIL ORDER SERVICE
"VIEW MASTER" & "TELE-KING" specialists
Easy terms available. Stamp (only) for lists
JAMES H. MARTIN & CO.,
FINSTHWAITE, NEWBY BRIDGE, ULVERSTON, LANCS.

UNIVERSAL METER SHUNTS
for 1 mA x 100 Ohm and 500 μA 500 Ohm meters. Accuracy 1%. Five Range model. No calibration or adjustment needed. S51A (1 mA) covers 2, 10, 50, 200 and 1,000 mA. S502A (½ mA) covers 1, 5, 25, 100 and 500 mA.
Price **15/-** each
Trade enquiries invited
R. HASSEY, 58, WAKEFIELD AVE., HULL

FERRANTI ELECTRONIC COMPUTERS

Ferranti Ltd. invite applications for vacancies in their ELECTRONIC COMPUTER DEPARTMENT. The vacancies described below are in their LONDON COMPUTER AND INFORMATION-HANDLING LABORATORY but vacancies of types (i) and(iii) exist also in the COMPUTER LABORATORIES in MANCHESTER.

(i) **Electrical Engineers and Physicists** for Computer Design Groups concerned with the design of analogue and digital computing circuits, visual displays, conversion equipment, storage systems, etc., and for basic research on interesting new techniques. Reference WSE(i).

(ii) **Electrical or Mechanical Engineer** for the Engineering Design Group. To work in close touch with Electronic Circuit Designers on principles and details of construction. Keen interest in advanced methods of construction is essential and experience of printed circuits or dip soldering and related techniques would be an asset. Reference WSE(ii).

(iii) **Electrical or Mechanical Engineer** for Engineering Design Group. For work on the design of precision instruments and components. Design experience in some branch of instrument technology is essential. Knowledge of optics and high-speed photography is an advantage. Reference WSE(iii).

(iv) **Electrical Engineer, Physicist or Mathematician** for compiling Technical Manuals primarily intended for use by maintenance personnel and covering both the logic and detailed electronics of machines designed by the Laboratory. This work is an excellent introduction to digital systems in general. The successful applicant may be required to assist in the training of maintenance personnel. Reference WSE(iv).

(v) **Mathematicians** for work on the logical design of computers and other digital systems. Some background in electronics would be an advantage, but is not essential. Reference WSE(v).

There are also vacancies for Project Leaders to take responsibility for projects through all stages. The positions offer scope for the exercise of initiative and for advancement in an expanding organisation. The Company operates a Staff Pension Scheme.

Application forms from Mr. T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs.

Please quote appropriate reference and indicate whether MANCHESTER or LONDON post is desired.

SITUATIONS VACANT

LEADING manufacturers of electronic equipment in the Provinces require a foreman for large coil-winding section; applicants should be fully experienced on Wesminster and other automatic interleaving machines; good salary and prospects to suitable man; write stating age and experience, to—The Personnel Manager (Ref. GLD), Box 0382. [4050

DEVELOPMENT engineers, qualified men with experience, interested in the design and development of domestic radio and television equipment, are offered interesting and progressive work in this field; situated in Midlands; applicants should write stating qualifications and experience, to—The Personnel Manager (Ref. GLD), Box 0861. [4029

ELECTRICAL/Electronic Engineer.—Vickers-Armstrongs, Ltd., Supermarine Works, require for employment at their experimental airfield, graduate with research and development experience in electronic and electro-mechanical devices and/or recording equipment for interesting work on ground and airborne measuring apparatus; the right man for this post will be keen on figures and assess new techniques and to design and engineer suitable and workmanlike equipment; permanent pensionable post with good prospects for suitable engineer.—Apply, Personnel Department, Hursley Park, Nr Winchester. [4000

JUNIOR development engineers are urgently required to assist in the development of precision electronic laboratory instruments; successful applicants will be engaged on interesting long-term projects concerned with the development of a wide range of equipment; the appointments are permanent and carry considerable technical responsibility; applicants should have had previous development experience preferably in the instrument field; academic qualifications ranging from H.N.C. to degree standard are preferable; salaries are dependent upon age, qualifications and experience.—Apply, stating full details to the Personnel Manager, Furzehill Laboratories Ltd., Boreham Wood, Herts. [3921

AIR MINISTRY requires Scientific Officer (male) at R.A.F. Station near High Wycombe, Bucks, for operational research duties, theoretical studies and development work in field of communications and general electronics. Qualifications: First or Second Class Honours degree in physics or electrical engineering, or equivalent. Salary: Within range £467/10—£845. Post unestablished with possibilities of establishment through Civil Service Commission whilst remaining under age 31. Opportunities for promotion to higher grade posts on staff of Scientific Adviser to Air Ministry.—Application forms, quoting A109/54A, from M.L.N.S., Technical and Scientific Register (K), 26, King St., London, S.W.1. Closing date February 11, 1955. [4025

MURPHY RADIO, Ltd., have vacancies in their Electronics Division Laboratories for qualified engineers to design and develop the following: (1) V.H.F. and U.H.F. communications equipment; (2) airborne and ground radar equipment; (3) computing devices and servo systems; (4) nucleonic equipment and measuring instruments; (5) transistors and associated circuitry; the salary range is £600–£1,000 per annum depending upon experience; further posts are available to engineers of H.N.C. standard or equivalent having less experience, the salary range being £450 to £650 per annum; these vacancies are at Welwyn Garden City but one or two vacancies of a similar nature are available at the Ruislip works.—Applications, giving age, full details of qualifications, experience and salary required, should be forwarded to Personnel Department, Murphy Radio, Ltd., Welwyn Garden City. [3991

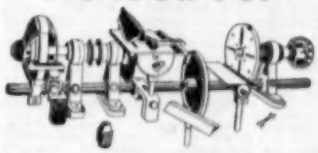
ELECTRONIC Engineer required at Ministry of Supply, Headquarters, London, to work in branch of Guided Weapons Directorate, responsible for planning and progressing contracts with various weapons firms. The officer will be required to visit these contractors during the course of his duties. Qualifications: Higher School Certificate (Science) or equivalent, but possession of degree or H.N.C. in Electrical Engineering may be an advantage. Knowledge of electronics required and some experience in guided weapons field would be an asset. Salary within Experimental Officer range (Min. age 26), £720—£900 p.a. (Women somewhat less) plus Pay Supplement of £50 p.a. —Application forms from Ministry of Labour and National Service, Technical and Scientific Register (K), 26, King St., London, S.W.1, quoting D.650/54A. Closing date February 11, 1955. [4025

ELECTRONIC engineers with several years' research or development experience are invited to apply for posts with a well established company engaged primarily on the development of precision electronic laboratory instruments; applicants should preferably possess a degree or equivalent qualifications in physics or light electrical engineering, although this is not essential as considerable practical experience is equally acceptable; the appointments are of a permanent nature for engineers able to undertake the responsibility for the development of new projects to the prototype stage, and they offer scope for the exercise of individual initiative; furthermore, the work covers a wide range of electronic instruments and similar devices; salaries are commensurate with qualifications and experience.—Applications should be made in writing, stating full details to Personnel Manager, Furzehill Laboratories Ltd., Boreham Wood, Herts. [3722

SSC Bargains from SHERMAN'S

Car Paid — Money-Back Guarantee!

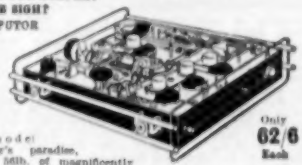
PICADOR PUP



The most versatile tool ever offered to the public. Woodturning lathe, rise and fall and fully tilting circular saw, hooded grindstone with drill sharpening attachment, sanding and drilling attachments, all accessories as illustrated. Complete **£6.15.0**

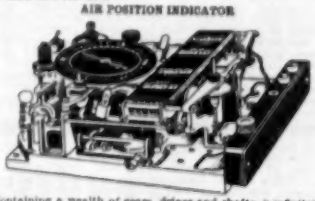
S.A.E. FOR LEAFLET

BOMB SIGHT COMPUTOR



A model maker's paradise, over 500lb. of magnificently made gears, driving shafts, bearings, miniature motor repeater motor, gyroscopes, etc. All supplied in a strong wooden transit case 24in. x 20in. x 11in. high which itself is ideal as a tool box. Only **62/6** Each

AIR POSITION INDICATOR



Containing a wealth of gears, drives and shafts, 5 infinitely variable gears, lampholders, repeater motors. Veeder counters. Been used by many Universities as a basis of a calculating machine. **£2.7.6**

ALL-STEEL TOOL BOX

Complete with removable inner tray. Fitted with strong hasp, staple and carrying handles.

Size 1, 14in. x 8in. x 8in. **25/-**

Size 2, 17in. x 8in. x 8in. **30/-**

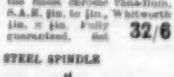
Size 3, 24in. x 8in. x 8in. **36/6**

SET OF 6 RING SPANNERS

12 point offset, made of the finest chrome vanadium. S.A.E. ¼in. to ¾in., Whitworth ⅛in. x ¼in. Fully guaranteed. Set **32/6**

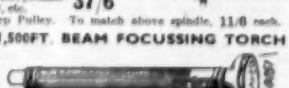
ALL-PURPOSE STEEL SPINDLE

15in. long. Complete with ¼in. capacity 3-jaw chuck, 4-speed pulley. Ideal for circular saw, grinder, polisher drill, etc. **37/6**



4-step Pulley. To match above spindle, 11/6 each.

1,500FT. BEAM FOCUSSING TORCH



Highly polished nickel-plate finish, heavy duty, 14in. long five standard U.2 batteries. Brand New. Batteries 2/6 extra. **17/6**

Send 3d. for New Catalogue

TERMS—CASH WITH ORDER. C.O.D. 1/- EXTRA. Phone Orders Accepted. (Dept. W11)

SHERMAN'S SSC SUPPLY COMPANY

85G, KILBURN HIGH ROAD, N.W.6.

67B HARROW ROAD, LONDON, W.10. LADbroke 1718

HIGH STREET, HARLESDEN, N.W.10.

SITUATIONS VACANT

TECHNICAL sales representative required for expanding manufacturing company in London. Applicants must be prepared to travel throughout country, have initiative, and be keen to make progress to appointment as assistant sales manager; applicants should have general technical background, be able to prepare advertising material, including brochures, and deal with correspondence; knowledge of tape recording equipment an advantage, but not essential; preferred age 25–40, car required, salary, commission and expenses. Initial training given.—Fullest details in confidence to Box 0956. [4059

ENGINEER, fully experienced in radio and television design and development, required to assist chief development engineer of leading London electrical component manufacturers in development of printed circuits; qualifications at least to A.M.I.E.E. standard; this position offers scope for the right man who must be capable of initiating and following projects to finality, including contacts with customers' superannuation scheme.—Write, giving full details of qualifications and experience, age and salary, required to Personnel Manager, Box 3M.L2242, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2. [3850

MINISTRY of Supply requires Electronics Technician in London Headquarters to help plan and progress production of variety of test equipment. Qualifications: British of British parents. Recognized engineering apprenticeship or equivalent training in electronics. Must know latest production methods for test equipment including specialised Army types. Knowledge contract procedure, and packaging, and inspection requirements peculiar to Services stores advantageous. Possession of H.N.C. or equivalent qualification desirable. Salary: Within £780–£950. Additionally a pay supplement within £25—£55 is payable. Not established but opportunities to compete for establishment may arise. Application forms from M.L. & N.S., T. & S.H., 26, King St., London, S.W.1. Quoting D644/54-A. [4024

TECHNICAL Supervisor required by Nigeria Posts and Telegraphs Department for one tour of 15-24 months with option of appointment either (a) on agreement with prospect of permanent and pensionable employment in salary scale (including expatriation pay): £1,210 rising to £1,515 a year or (b) on contract in a temporary capacity with salary (including expatriation pay) £1,307 rising to £1,453 a year; gratuity at the rate of £150 a year; outfit allowance of up to £60; free passages for officer and wife; assistance towards cost of children's passages or grant up to £150 annually for maintenance in U.K.; liberal leave on full salary; candidates must hold C. and G. Intermediate Certificate in Telecommunications Engineering and have passed the final paper in Line Transmission II or (2) Telegraph (II) or (3) Radio IV, and should have had considerable experience in the maintenance of V.H.F. multichannel equipment and associated carrier and V.F. telegraph equipment as major V.H.F. terminals.—Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30626/WF. Candidates at present employed by the G.P.O. should submit their applications through their Establishment Division. [4002

TECHNICAL TRAINING

IF you possess knowledge of radio and wish to train in television, obtain full details of a home study course using the latest training methods by writing to Box 0955. [4055

LEARN it as you do it—we provide practical equipment combined with instruction in radio, television, electricity, mechanics, chemistry, photography, etc.—Write for full details to E.M.I. Institutes, Dept. WW.47, London, W.4. [0001

CITY and Guilds (Electrical, etc.) on "No Pass—No Fee" terms; over 95% successes.—For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook, free and post free. B.I.E.T. (Dept. 388A), 29, Wright's Lane, London, W.8. [0117

TUITION

NOTHING succeeds like success! What we have done a thousand times we can do again for you—see the B.N.R.S. advt. page 148. [0172

WIRELESS operating; attendance and postal courses.—Stamp for reply to Manager, The Wireless School, Manor Gdns., London, N.7. [0104

T/V & Radio—A.M.Brit.I.R.E., City & Guilds, R.T.E.B. Certs., etc., on "No Pass—No Fee" terms; over 95% successes.—Details of Exams. and Home Training Courses in all branches of Radio and T/V; write for 144-page Handbook—Free. B.I.E.T. (Dept. 387A), 29, Wright's Lane, London, W.8. [0116

FULL-TIME courses for P.M.G. Certs., C.G.L.I. Telecommunications, Radar Maintenance Cert. and B.Sc.(Eng.); prospectus free.—Technical College, Hull. [0111

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds etc., on "No Pass—No Fee" terms; over 95% successes.—For details of Exams. and courses in all branches of Engineering, Building, etc., write for 144-page Handbook—Free. B.I.E.T. (Dept. 387B), 29, Wright's Lane, London, W.8. [0118

PYE LIMITED
CAMBRIDGE

Vacancies exist in the Engineering and Research Laboratories of the above progressive organisation for Senior and Junior Engineers and Drawing Office personnel to work in each of the following fields:—

(1) T/V transmitters, aerials and ancillary equipment.
(2) T/V studio and waveform equipment.
(3) Radio and T/V broadcast receivers.
(4) Microwave equipment.
(5) Applications of transistors and other semi-conductor devices.
(6) Transformer design.
(7) Precision electro-mechanical devices.
(8) Electrical servo-mechanisms and control systems.

There are also vacancies for men qualified as radio mechanics for installation and maintenance work.

Salaries will be on a generous scale and in accordance with qualifications and experience. Basic 40-hour week, paid overtime, profit-sharing scheme, pension scheme, canteen, sports club, benevolent fund.

Please write indicating which of the above fields interests you and giving brief details of your attainments to date, to the **Chief Engineer, PYE LIMITED, CAMBRIDGE.** Correspondence will be treated in strict confidence.

TESTERS

required for high grade RADAR and ELECTRONIC WORK. Ordinary or Higher National Certificate an advantage, but men with suitable Service or Civilian experience will be considered. Opportunities of advancement available for progressive candidates. Good rates of pay, canteen facilities, etc., etc. Apply to the Employment Department, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester 17.

BRASS, COPPER, DURAL, ALUMINIUM, BRONZE
ROD, BAR, SHEET, TUBE, STRIP, WIRE
3,000 STANDARD STOCK SIZES
No Quantity too Small *List on application*
H. ROLLET & Co., Ltd.
6 Chesham Place, S.W.1. *SLOane* 3461
ALSO AT LIVERPOOL, BIRMINGHAM, MANCHESTER, LEEDS

MALVYN ENGINEERING WORKS
Precision Engineers
Manufacturers of: Chassis, Small Pressings, Machined Components, Wiring and Mechanical Assemblies, to specification.
Single and Production Quantities. Enquiries Invited
100 PARK ROAD, WARE, HERTS.
Telephone: Ware 465

TUITION

SEE the world as a Radio Officer. Short training period—low fees. Scholarships, etc., available. Boarding and day students. Send 2½d stamp for prospectus.—Wireless College, Colwyn Bay. [0018

PRACTICAL evening courses in radio and television engineering; commencing end of January; write for details.—Manchester Radio & Television School, 52, Young St., Manchester, 3. Bla. 6967. [3974

THE Institute of Practical Radio Engineers have available home study courses in every phase of radio and television engineering, specialising in the practical training of apprentices in the retail trade; enrolments limited, fees moderate.—The Syllabus of Instructional Text may be obtained post free from the Secretary, I.P.R.E., Fairfield House, 20, Fairfield Rd., Crouch End, London, N.8. [0088

OPPORTUNITIES in radio and television servicing; full-time theoretical and practical 1-year course at E.M.I. Institutes in London; job assured on successful completion; next course commences on April 19th; early enrolment is advised.—Free brochures giving details of these and other courses from E.M.I. Institutes, Dept. WW36, 10, Pembridge Sq., London, W.2. Tel. Bayswater 5131/2. [3972

FREE!—Brochure giving details of Home Study Training in Radio, Television, and all branches of electronics; courses for the hobby enthusiast, or for those aiming at the A.M.Brit.I.R.E., City and Guilds, R.T.E.B., and other professional examinations; train with the College operated by Britain's largest electronics organisation; moderate fees.—Write to E.M.I. Institutes, Dept. WW.28, London, W.4. [0179

WIRELESS telegraphy.—Merchant Navy offers to youths 16 upwards after qualification, lucrative positions as radio officers.—Apply British School of Telegraphy, 179, Clapham Rd., S.W.9 (Est. 1906). Recognised by Ministry of Education, moderate fees, modern equipment, day and evening tuition; also postal courses in theory of wireless telegraphy for P.M.G. Certs. and Amateur Transmitting Licence. [0124

TRADE MARKS

TRADE Mark No. 706195 consisting of the word "Solartron" and registered in respect of Electronic and electrical apparatus and instruments; scientific, nautical, surveying, radio, television, photographic, cinematographic, optical, weighing, measuring, signalling, checking (supervision), teaching, counting, accounting, adding and calculating apparatus and instruments; apparatus and instruments for recording and indicating pressure, temperature and speed; sound recording transmitting and reproducing apparatus and instruments; and parts, was assigned on 14th September, 1954, by Solartron Laboratory Instruments Limited of Solartron Works, Queens Road, Farnham Common, to the Solartron Electronic Group Limited of the same address without the go dwill of the business in which it was then in use. [4046

BOOKS INSTRUCTIONS, ETC.

BOOKS, technical, 1935, half price, unmarked; write list.—Box 0856. [4018

WIRELESS World, Nov. 1937 to Dec. 1953; offers.—Loveland, 34, Crockford Park Rd., Addlestone, Surrey. [4050

I.P.R.E. technical publications, 5,500 Alignment Peaks for Superheterodynes, 5/9, post free. data for constructing TV aerial strength meter, 7/6; sample copy "The Practical Radio Engineer," quarterly publication of the Institute 2/-; membership and examination data, 1/-.—Sec., I.P.R.E., 20, Fairfield Rd., London, N.8. [0089

"CASH From Your Camera." By Arthur Nettleton, F.R.G.S. Shows how amateur photography can be made to pay for itself by the sale of pictures to newspapers, magazines, calendar publishers, etc., and deals with the many problems involved. 2nd Edition. 7/6 net from all booksellers. 7/10 by post from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

"RALLIES and Trials." By S. C. H. Davis of "The Autocar." Describes in a colourful style the author's many adventures whilst driving in rallies and trials in all parts of Britain and Europe. The Monte Carlo Rally, the exciting Alpine Trials and many other spectacular events are recalled by this world-renowned racing driver. 15/- net from all booksellers. 15/7 by post from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

MORLEY TRANSFORMERS
QUALITY P.P.O./P. TRANS, 20w., super Silicoriams Section low leakage windings, prim. ind. 75H, leakage ind. 075H. Sec. 2 and 15 ohms Prim. to indiv. requirements. Shrouded and term., wt. 5 lbs. **3 gns.** Ditto 15 w., **21 gns. L.P. CHOKES,** 10H. 65 mA. **4/6.** 15H. 100 mA., **10/6.** 20H. 150 mA., **12/6. CRT Htr.** Isolation Trans., 35/-, acc. boost volt., 2 v., **10/6;** 6.3 v., **10/6. MAINS TRANS.** 0-200/250 v. tapped prim. 350-0-350 v. 80 mA. 5 v. 2 a., 6.3 v. 4 a., etc., from **21/-,** 6.3 v. 1½ a. Htr. Trans., **7/6.** Quotations for specials and rewinds. Part P. & P. 1/-.
2, PAWSONS RD., W. CROYDON, TNO 1665

FIRE FIEND v. NU-SWIFT

We know who will win. Please send us details of your wonderfully rapid and reliable Fire Extinguishers—before it is TOO LATE!

Name .....

Address .....

Post now to Nu-Swift Ltd., Elland, Yorks. —AHEAD OF THE FIRE FIEND'S VISIT!

In Every Ship of the Royal Navy

Fluorescent 80w 5-ft Industrial Trough reflector fitting, white stove enamelled. Complete in every detail, ready to hang with tube for 210/240v a.c. mains. Cash **£3-15-0.**

Despatched free, by return anywhere Gt. Britain

NEW — GUARANTEED

KINGSTON ELECTRICAL SUPPLIES, 134 London Rd., Kingston-on-Thames

FERRANTI LIMITED, EDINBURGH

—FLIGHT TRIALS DIVISION—

APPLICATIONS ARE INVITED FOR

ELECTRONIC ENGINEER for interesting work in their Flight Trials division. The engineer will be engaged on trials to evaluate the technical and operational performance of fire control and navigational systems, air and ground. The qualifications required are to degree or equivalent standard with a minimum of three years' experience. Ref. No. 59/EE/TID.

RADAR MAINTENANCE ENGINEER who will be responsible for a small outstation. Duties will involve limited travelling in the U.K. Ref. No. 59/RME/TID.

Ex Radar Officers and Senior N.C.O.s are invited to apply for either or both vacancies. The appointments are pensionable and offer excellent prospects and working conditions in or attached to our new laboratories.

Apply for an application form, quoting appropriate reference number to the

PERSONNEL OFFICER,
Ferranti Limited, Ferry Road, Edinburgh, 5.

ENGINEERS AND PHYSICISTS

Ferranti Limited in their new Laboratories are engaged in a programme of electronic development of great industrial importance. The work involves the use of digital computers to control machines and industrial processes, and covers a wide and expanding field of application, offering long-term interest to those engaged in it. Development activity for these projects is taking place in the fields of electronic circuitry (including pulse technique), digital computers, magnetic recording and servomechanisms. Engineers and Physicists having experience as well as interest in one or more of these subjects are invited to apply.

The appointments are permanent and offer full scope for initiative in an expanding organisation. A salary commensurate with the qualifications required will be paid. Staff Pension Scheme. Application form will be sent on request quoting Ref. 59/EP/AL) to the

PERSONNEL OFFICER,
Ferranti Limited, Ferry Road, Edinburgh, 5.

CLASSIFIED ADVERTISEMENTS

Use this Form for your Sales and Wants

To "Wireless World" Classified Advertisement Dept., Dorset House, Stamford Street, London, S.E.1

PLEASE INSERT THE ADVERTISEMENT INDICATED ON FORM BELOW

- **RATE: 7/- for TWO LINES. 3/6 every Additional Line. Average six words per line.**
- **Name and address to be included in charge if used in advertisement.**
- **Box No. Allow two words, plus 1/-.**
- **Cheques, etc., payable to Iliffe & Sons Ltd., and crossed "& Co."**
- **Press Day, January 27th for March issue.**

NAME .....

ADDRESS .....

.....

REMITTANCE VALUE.....ENCLOSED

Please write in block letters with ball pen or pencil.

NUMBER OF INSERTIONS.....

INDEX TO ADVERTISERS

	PAGE
A.A. Tools	152
Acoustical Mfg. Co., Ltd.	29
Acru Electric Tool Mfg. Co., Ltd., The	74
Adcola Products, Ltd.	58
A.D.S. Repairs, Ltd.	160
Advance Components, Ltd.	28
Airmec, Ltd.	26
Allen-Dixon	156
Alpha Radio Supply Co., The	122
Altham Radio Co.	113
Amplex Appliances (Kent), Ltd.	118
Anders Electronics, Ltd.	66
Anglo-American Vulcanised Fibre Co., Ltd.	44
Antex	59
Antiference, Ltd.	101
Appointments Vacant 148, 162, 165, 164,	165
Arcolectric Switches, Ltd.	42
Ariel Sound	158
Armstrong Wireless & Television Co., Ltd. 50, 75,	151
Army Emergency Reserve (Royal Signals)	40
Ashworth, H.	54
Associated Cine Equipments, Ltd.	62
Australian Post Office	114
Automatic Coil Winder & Electrical Equipment Co., Ltd., The	1
Autoset (Production), Ltd.	106

Barker Natural Reproducers	151
Barton's (Radio)	121
Beamish, V. W.	160
Belling & Lee, Ltd.	85
Bell, John, & Croyden	120
Bel Sound Products, Ltd.	158
Benson, W. A.	146
Berry's (Short Wave), Ltd.	68
Birmingham Sound Reproducers, Ltd.	80
B. K. Partners, Ltd.	52
Blickvac Engineering, Ltd.	117
Blundell, O.	160
Bradmatic, Ltd.	68
Brighton Radio Co.	118
Britain, Chas. (Radio), Ltd.	145
British Communications Corpn., Ltd.	25
British Distributing Co.	160
British Institute of Engineering Technology 155,	154
British Insulated Callender's Cables, Ltd.	Cover ii
British National Radio School	148
British Physical Laboratories	63
British Sarazol, Ltd.	14
Brookes Crystals, Ltd.	58
Brown, S. G., Ltd.	56
Bulgin, A. F., & Co., Ltd.	Edit. 93
Bulgin, A. F., & Co., Ltd.	48
Bulgin, A. F., & Co., Ltd.	70
Bull, J., & Sons	167
Butcher, H., & Co.	

Candler System Co.	156
Cape Electrophonics, Ltd.	155
Cathodeon Crystals, Ltd.	4
Cementation (Muffelite), Ltd.	75
Chaffey Cabinet Co.	160
Champion Products	159
Chapman, C. T. (Reproducers), Ltd.	157
Cie Generale de Metrologie	102
Cinema Television, Ltd.	27
City Radio Exchange, Ltd.	110
Classic Electrical Co., Ltd.	77
Clydesdale Supply Co.	147
Clyne Radio, Ltd.	134, 135
Cohen, D.	136, 137
Cosmocord, Ltd.	84
Cosor, A. C., Ltd.	86
Coventry Radio	152
Cranston, Alan	162

Davies, A., & Co.	156
Davis, Jack (Relays), Ltd.	119
Denco (Clacton), Ltd.	71
Direct T.V. Replacements	70
Dixon, L., & Co.	153
Donohoe's (Tuners)	160
Dubilier Condenser Co. (1925), Ltd.	
Duke & Co.	157
Dukt Co., Ltd., The	157
Dun-Sobleson Electrical Co.	156

Easco Electrical, Ltd.	162
Edison Swan Electric Co., Ltd. 45, 69,	87
Egen Electric, Ltd.	5
Electrical Instrument Repair Service, The	158
Electro-Acoustic Developments	159
Electro-Acoustic Industries, Ltd.	12
Electronic Precision Equipment 96, 97, 98,	99
Electro-Winds, Ltd.	120
Ellison Transformers, Ltd.	112
E.M.I. Factories, Ltd.	88
E.M.I. Institutes 2, 54, 91,	94
English Electric Valve Co., Ltd.	108
Enthoven Solders, Ltd.	95
Ever Ready Co. (Gt. Britain), Ltd., The	158
E.W.A.	

Ferranti, Ltd.	23
Filmer, J. T.	156
Fisher Electronics Co., Ltd.	53
Foyle, W. & G., Ltd.	116
Furmikit	60
Furzehill Laboratories, Ltd.	61

Galpins	159
Gardners Radio, Ltd.	111
Gee Bros., Radio, Ltd.	156
General Electric Co., Ltd.	18
Glaser, L., & Co.	156
Glover, W. T., & Co., Ltd.	59
Goodmans Industries, Ltd.	49
Goodsell, Ltd.	52
Gramophone Co., Ltd., The	87
Gray, Arthur, Ltd.	114
Griffiths Hansen (Recordings), Ltd.	160
Grundig (Gt. Britain), Ltd.	102

Hall Electric, Ltd.	111
Hanney, L. F.	144
Harris, P.	150
Hartley, H. A., Co., Ltd.	104
Hatfield Radio	50
Heath Spring & Notion Co., Ltd.	106
Henley's, W. T., Telegraph Works Co., Ltd.	155
Henry's	143
H.H. Ltd.	62
Hivac, Ltd. 60,	115
Holley's Radio	100
Homelab Instruments, Ltd.	120
Household Electrix, Ltd.	107
H.P. Radio Services, Ltd.	72
Hudson Electronic Devices, Ltd.	109
Hunt, A. H. (Capacitors), Ltd.	19
Hunton, Ltd.	64

Iliffe Books 66, 79,	142
Industrial Electronics	75
International Correspondence Schools	56

Jackson Bros. (London), Ltd.	115
Jackson Radio	162

Kaye Electrical Mfg. Co.	146
Kempner, S.	56
Kenroy, Ltd.	156
Keyswood Co., The	104
Kingston Electrical Supplies	165
Kolectric, Ltd.	66
Kosmic, B.	146

Lafco Compounds, Ltd.	157
Lancaster Hi-Fidelity Acoustical Equipment Co.	116
Lasky's Radio 129, 150,	151
Lead, H. J., & Co., Ltd.	93
Lee Products (Gt. Britain), Ltd.	46
Leevers-Rich Equipment, Ltd.	74
Lewis Radio Co.	150
Light Soldering Developments, Ltd.	150
Lockwood & Co.	156
London Central Radio Stores	156
Loshner Mfg. Co.	63
L. R. Supply Co., Ltd.	107
Lyons, Claude, Ltd.	1
Lyons Radio	146

Magnetic Coatings, Ltd.	62
Magnetic Devices, Ltd. 16,	65
Mail Order Supply Co.	21
Malvyn Eng. Co.	164
Maroni Instruments, Ltd.	10
Marconi's Wireless Telegraph Co., Ltd.	90
Martin, J. H.	164
Massey, R.	162
McGraw-Hill Publishing Co., Ltd.	92
McMurdo Instruments Co., Ltd.	72
Metropolitan-Vickers Electrical Co., Ltd	103
Midland Instrument Co.	142
Minnesota Mining & Manufacturing Co., Ltd.	64
Modern Book Co.	150
Modern Electrics, Ltd.	112
Modern Sound Equipments	160
Modern Techniques	94
Morley Transformers	164
M.R. Supplies, Ltd.	68
Mullard, Ltd. 3, 7, 20, 48, 67,	82
Multicore Solders, Ltd. 54, Cover	v
Muirhead Electric Co., Ltd.	84
Murex, Ltd.	30

Northern Radio Services 36,	37
Norton & Gregory, Ltd.	47
Norwegian Mining, Ltd.	120
Nu Swift, Ltd.	165

Oddie, Bradbury & Cull, Ltd.	154
Omnia Radio Products, Ltd.	55
Oxley Developments Co., Ltd.	156

Painton & Co., Ltd.	13
Parker, A. B.	116
Parsonage, W. F., & Co., Ltd.	156
Partridge Transformers, Ltd.	149
P.C.A. Radio	142
Pearce, J. W.	146
Philips Electrical, Ltd.	46
Phillips Control (Gt. Britain), Ltd.	74
Plasticable, Ltd.	118
Pledge Co., Ltd., The	12
Post Radio Supplies	152
Power Controls, Ltd.	27
Pratt's Radio	120
Premier Radio Co. 76, 77, 78,	79
Proops Bros., Ltd.	156
Pye, Ltd. 24,	59
Pye, W. G., & Co., Ltd.	6

Quality Equipment Designers, Ltd.	119
Quartz Crystal Co., Ltd.	154

Radio & Electrical Mart, The	140
Radio Component Specialists	128
Radio Corporation of America	30
Radio Kits, Inc.	160
Radio Servicing Co.	119
Radiospares, Ltd.	152
Radio Supply Co. 152,	153
Radio Traders, Ltd.	144
Reproducers & Amplifiers, Ltd.	53
Rexon Industries, Ltd.	56
Robinson, F. C., & Partners	100
Roding Laboratories	110
Rogers Development Co.	44
Rollet, H., & Co., Ltd.	164
Runbaken Electrical Products	162

Salford Electrical Instruments, Ltd.	54
Sallis, A. T.	146
Samsons Surplus Stores	138
Savage Transformers, Ltd.	153
Service Radio Spares	144
Sherman's Supply Co.	163
Sifam Electrical Instruments Co., Ltd.	40
Simmonds, L. E., Ltd.	58
Simon Sound Service	58
Smith, G. W. (Radio), Ltd.	139
Smith, H. L., & Co., Ltd.	152
Smith, W. H., & Sons, Ltd.	108
Solartron Electronic Group, Ltd.	102
Sound Sales, Ltd.	94
Southern Radio Supply, Ltd.	161
Specialist Switches	158
Spencer-West	154
Stamford, A. L.	162
Standard Telephones & Cables, Ltd. 41, 85,	92
Star Metal Plate Works	158
Stead, J., & Co., Ltd.	50
Stern Radio, Ltd. 123, 124, 125, 126,	127
Stewart Transformers, Ltd.	104
Sugden, A. R., & Co. (Engineers), Ltd.	60
Supasolda	146
Superior Radio Supplies	113
Sutton Coldfield Electrical Engineers	74

Tannoy Products, Ltd.	158
Taylor Electrical Instruments, Ltd.	43
Telecraft, Ltd.	160
Telegraph Condenser Co., Ltd. Cover	iii
Tele-Radio (1943), Ltd.	57
Teletron Co., The	152
Thorn Electrical Industries, Ltd.	11
Trianon Electric, Ltd.	32
Trix Electrical Co., Ltd. Edit.	97
Truvox, Ltd.	113

Unitelex (London), Ltd.	70
Universal Book Co.	160
Universal Electrical Instruments Corpn.	141
Universal Electronics 110,	147

Valradio, Ltd.	116
Verdik Sales, Ltd.	61
V.E.S. Wholesale Services, Ltd.	120
Vitavox, Ltd.	74
Vortexion, Ltd.	93

Watson Watch Co., The	162
Watts, Cecil E.	162
Wayne Kerr Laboratories, Ltd., The	9
Webber, R. A., Ltd.	116
Webb's Radio 106,	162
Welwyn Electrical Laboratories, Ltd.	104
West End Radio, Ltd.	152
Westinghouse Brake & Signal Co., Ltd.	75
Weymouth Radio Mfg. Co., Ltd., The	42
Wharfedale Wireless Works	100
Whitaker, H.	120
Whiteley Electrical Radio Co., Ltd.	51
White, S. S., Co. of Gt. Britain, Ltd., The	51
Whittemore, A. J. (Aeradio), Ltd.	160
Wilkinson, L.	161
Willesden Transformer Co., Ltd.	56
Woden Transformers, Ltd.	117
Wolf Electric Tools, Ltd.	42
Woollies Radio & Electrical Supplies, Ltd	140
Woolwich Polytechnic	116
Wright & Weaire, Ltd.	5

Young, C. H.	158

Z. & I. Aero Services, Ltd.	140

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford St., London, S.E.1, by CORNWALL PRESS LTD., Park Gardens, London, S.E.1. *Wireless World* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd., William Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co.

The most promising manufacturing development for 20 years!

★ **Eliminates many expensive chassis operations.**

★ **Saves material and speeds assembly.**

★ **Virtually replaces all hand wiring.**

★ **Greater compactness cuts cabinet costs.**

★ **Ensures uniformly consistent performance.**

Thoroughly experienced in the accurate appraisal of all new electronic developments, T.C.C. has been quick to recognise the far reaching advantages to the Industry of the Printed Circuit.

For here, we predict, is something destined to revolutionise the whole process of assembly. Developments already carried out in the T.C.C. laboratories indicate that this new technique, by the elimination of much costly chassis presswork, permits great savings to be effected in time, labour and materials.

But the advantages are not confined to production alone. Already much evidence has been accumulated to prove that the Printed Circuit permits the immediate achievement of higher standards of performance with a far greater degree of consistency and reliability than hitherto deemed possible.

Those interested in the various applications of Printed Circuits in the electronic industry are invited to register their names to receive our Technical Bulletins as issued. Manufacturers should apply to our Special Products Division for details of service available.

PRINTED CIRCUITS

by TCC

THE TELEGRAPH CONDENSER CO. LTD

SPECIAL PRODUCTS DIVISION · North Acton · London · W.3 · Tel: ACORN 0061

Whatever your soldering problem

MULTICORE SOLDERS LTD.

give you the right answer

You will find the right solder for any soldering job in the comprehensive Multicore range of gauges, alloys and fluxes. And you will find it economical too, because the 5 separate cores of Ersin Flux in Ersin Multicore Solder provide a steady flux stream; no lengths of solder are wasted and the risk of making dry joints through insufficient flux is eliminated. Ersin Flux is a very fast activated rosin which cleans even the most heavily oxidised surfaces at great speed. As Ersin Multicore 5-core Solder is so fast, it is often possible to make considerable savings by equally effectively using an alloy of lower tin content.

FOR FACTORY USE

Ersin Multicore Solder is supplied on 7 lb. reels for factory use in 6 standard tin/lead alloys and 9 gauges from 10 to 22 s.w.g. Finer gauges are supplied on ¼ lb. reels. It is also made in special high and low melting point alloys and meets all A.I.D., G.P.O. and A.R.B. requirements. Prices on application.

1 lb. REEL 15/- (SUBJECT)

FOR SERVICE ENGINEERS

For service engineers and radio enthusiasts the 5/- (subject) Size 1 Carton is the handiest size and there are 4 specifications to choose from. The 1 lb. reel (price 15/- subject) contains approximately 167 ft. of 18 s.w.g. Ersin Multicore Solder in 50/50 alloy.

SIZE 1 CARTONS 5/- (SUBJECT)

Catalogue Ref. No.	Alloy Tin Lead	S.W.G.	Approx. length per carton
C 16014	60/40	14	21 feet
C 16018	60/40	18	55 ,,
C 14013	40/60	13	19 ,,
C 14016	40/60	16	38 ,,

SPECIALISED PRODUCTS FOR MANUFACTURERS

LIQUID AND JELLY FLUXES

Ersin Flux in liquid form is available for processes where cored solder cannot be used. For large surfaces to which insufficient liquid flux would adhere, there is a high viscosity red jelly which is supplied in size 12 tins at 4/6 each (subject). It is approved by the Ministry of Supply.

Bib WIRE STRIPPER & CUTTER

For the modest price of 3/6 you can get a Bib Wire Stripper and Cutter—a handy 3 in 1 tool that will save you hours of time and irritation. The sturdy, nickel-plated tools strip insulation without nicking the wire, cut wires cleanly and split plastic extruded twin flex. They are adjustable to most wire thicknesses. **3/6 (SUBJECT).**

Bib RECORDING TAPE SPLICER

FOR TAPE RECORDING ENTHUSIASTS

Among the enthusiastic comments made by the press is the following one by P. Wilson, Technical Editor of 'The Gramophone', who says in the Jan. 1955 issue: "*. . . . Everyone who uses a tape recorder will need this little tool. It is indispensable. . . .*" Price **18/6 (SUBJECT).**

MULTICORE SOLDERS LTD., MULTICORE WORKS, HEMEL HEMPSTEAD, HERTS. (BOXMOOR 3636)